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November, 1944

EDISON ELECTRIC INSTITUTE BULLETIN

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THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

August, 1943 and 1944

SOURCE AND DISPOSAL OF ENERGY—MONTH OF AUGUST

	1944	1943	%
GENERATION* (Net)			
By Fuel Burning Plants	13,985,008,000	13,307,312,000	+ 5.1
By Water Power Plants	5,779,346,000	5,888,406,000	− 1.9
Total Generation	**19,764,354,000**	**19,195,718,000**	**+ 3.0**
Add—Net Imports over International Boundaries	151,208,000	141,605,000	+ 6.8
Less—Company Use	133,311,000	133,126,000	+ 0.1
Less—Energy Used by Producer	491,003,000	862,381,000	−43.1
Net Energy for Distribution	**19,291,248,000**	**18,341,816,000**	**+ 5.2**
Losses and Unaccounted for	2,637,581,000	2,476,097,000	+ 6.5
Sales to Ultimate Customers	**16,653,667,000**	**15,865,719,000**	**+ 5.0**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of August 31st			
Residential or Domestic	27,236,787	26,832,206	+ 1.5
Rural (Distinct Rural Rates)	1,144,906	1,085,175	.....
Commercial or Industrial:			
Small Light and Power	4,219,821	4,155,506	+ 1.6
Large Light and Power	150,988	146,859	
Other Customers	115,387	116,983	.....
Total Ultimate Customers	**32,867,889**	**32,336,729**	**+ 1.6**
KILOWATTHOUR SALES—During Month of August			
Residential or Domestic	2,401,438,000	2,219,286,000	+ 8.2
Rural (Distinct Rural Rates)	431,621,000	366,251,000	+17.8
Commercial or Industrial:			
Small Light and Power	2,519,633,000	2,394,881,000	+ 5.2
Large Light and Power	9,764,185,000	9,290,380,000	+ 5.1
Street and Highway Lighting	160,466,000	154,783,000	+ 3.7
Other Public Authorities	735,834,000	801,979,000	− 8.2
Railways and Railroads:			
Street and Interurban Railways	351,883,000	352,196,000	− 0.1
Electrified Steam Railroads	215,589,000	209,184,000	+ 3.1
Interdepartmental	73,018,000	76,779,000	− 4.9
Total to Ultimate Customers	**16,653,667,000**	**15,865,719,000**	**+ 5.0**
Revenue from Ultimate Customers	**$271,444,200**	**$253,829,500**	**+ 6.9**

RESIDENTIAL OR DOMESTIC SERVICE

AVERAGE CUSTOMER DATA—For 12 months ended August 31st			
Kilowatthours per Customer	1,127	1,053	+ 7.0
Average Annual Bill	$39.90	$38.12	+ 4.7
Revenue per Kilowatthour	3.54¢	3.62¢	− 2.2

(*) By courtesy of the Federal Power Commission.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 12 NOVEMBER, 1944 No. 11

Memorandum on Post-War Taxes

By Grover C. Neff

President, Wisconsin Power and Light Company

NEARLY all of the post-war tax plans that have been developed assume an annual U. S. Income of approximately one hundred twenty to one hundred sixty billion dollars. Most of them assume that the federal government will have to have an income from taxes of approximately eighteen to twenty billion dollars a year. I have never heard any very convincing evidence to indicate that we will have an income of from one hundred twenty to one hundred sixty billion dollars a year, but there isn't much doubt that we will have to have twenty billion dollars a year to operate the federal government.

The average annual income of this country for the ten years preceding the present war was approximately sixty billion dollars. The annual income for the year 1929, when we reached the crest of our pre-war prosperity, was eighty-nine billion dollars. It is a big jump from sixty billion dollars to one hundred twenty billion dollars or even from eighty-nine billion dollars to one hundred twenty billion dollars, and it will take the most careful planning and execution if we are to reach the goal set by the people who have prepared these post-war tax plans. It appears to be necessary to reach this goal of at least one hundred twenty billion dollars of annual income if we are to remain solvent. It is, therefore, very important that everything possible be done to help this country develop in such a way that we reach this objective.

American business must be active, energetic, and must increase its old peacetime rate of operation in order to give jobs to everyone. Government must be cooperative and helpful in this development. Unless these things are done, we can be sure that we will not reach our annual income of one hundred twenty to one hundred sixty billion dollars. To achieve this required goal, there is one thing government will have to do. It will have to equalize the tax burden on business.

The business of this country is now carried on in three major divisions: One, by companies, partnerships, and individuals and usually referred to as private business; two, by cooperatives; three, by government—federal, state, or local. Many different lines of business are conducted by all three of these groups, yet they are treated very differently in the matter of taxes.

Private business, so-called, is now very heavily taxed. In the electric utility field, electric operating companies pay about 25 per cent of their gross revenue in taxes, the major portion of which goes to the federal government. Electric utility business carried on by cooperatives pays no federal taxes and in many states, very little state or local taxes. Electric utility business carried on by the government pays no federal taxes, no state taxes, and in many cases no local taxes. Similar examples could be taken from many other lines of business and the story would be the same; that is, private business is paying very heavy taxes, and cooperatives and government-owned businesses are paying very little taxes.

This is a very unhealthy condition, which will have to be corrected by the government if business in this country is to grow and expand so that the annual income will be in the neighborhood of one hundred twenty to one hundred sixty billion dollars and everyone in this country will have a job. Taxes have become such a large part of the cost of doing business that no concern that has to pay these heavy taxes can long compete with a co-op or government concern that does not have to pay taxes. Certainly, investors will not risk their money in private enterprises while they have such a disadvantage from the very start. In other words, this unfair tax differential acts as a brake on the expansion of private business. We cannot afford to have anything holding back private business if we are to reach the goal of one hundred twenty to one hundred sixty billion dollars of an annual income and jobs for everyone.

If private business continues to pay the high taxes that are necessary, and if these other groups remain practically tax-free, this discrimination will not only put a brake on the *expansion* of private business but it will also destroy *present* private business. More and more of our business will be done by tax-free cooperatives and tax-free government-owned concerns. The present situation is very unfavorable to rapid growth and expansion and even the continued existence of private business.

We cannot have part of a business heavily taxed and another part of the same business tax-free without destructive results. Certainly, with this set of conditions, we cannot expect private business to expand and grow enough to produce the annual income on which the post-war plans of taxation are based. It is important that all business, regardless of ownership, pay its fair share of the tax load. Unless this is done, and it requires government action to bring it about, it is quite certain that the national income will fall far below the amount necessary to keep this country solvent.

We often hear that the tax load should be distributed according to the ability to pay. There is a lot to be said for this statement. Originally, it referred to the amount of net income that was left to the individual or organization in question. The theory was that the more net income one had, the more taxes one should pay. There appears to be nothing wrong with this thinking,

However, by manipulating the business so that there is no net taxable income, it is possible to avoid paying taxes. I wish to discuss this feature now.

Any American company in business must have net income in order to finance itself and keep in a solvent condition. Every solvent American business has net income on which it must pay taxes. This is not necessarily true of many co-operatives and government-owned concerns in business. Our laws are such that REA co-ops can borrow money from the federal government at an exceedingly low rate of interest and the amount borrowed can equal 100 per cent of the total investment made. It is credit with the federal government that makes it possible to borrow this money at a low rate of interest. Then this electric co-operative can reduce the selling price of its product to such a point that it takes in only enough money to pay its operating costs, interest, and a small amortization charge to the federal government. It need not have net earnings over and above these amounts and still it can carry on a business without financial difficulty, because our present federal laws enable it to do these things. I believe this same thing is true in other lines of business—at any rate, the cooperative does not have to have net earnings like a company that keeps in sound and healthy condition.

The co-op sells its products at a price less than normal because it does not have to have net earnings and does not have to pay taxes. There isn't any reason why this co-op should not be made to pay taxes the same as an electric company which furnishes the same kind of service over the same kind of lines to the same kind of farmers. If the laws were modified so that an electric co-op which serves 500 farmers had to pay about the same amount of taxes to the federal government as an electric operating company has to pay on its business to 500 similar farmers, then we would be distributing the tax burden fairly. All the co-op would have to do would be to increase the price of the product sold to its customers. It would then collect from these customers an amount sufficient to pay for operating the co-op, pay the small interest and amortization charges to the federal government, and pay taxes to the federal government.

Because of the very nature of the co-op and the laws governing its operation, legislation should be enacted which will cause the co-op with a given amount of business to pay federal taxes somewhere nearly equal to those paid by private companies doing the same amount and kind of business. I refer to electric operating companies and electric co-ops because I am more familiar with that setup than any other, but the chances are that the same situation prevails in other lines of industry.

If the co-ops assumed their fair proportion of the tax burden by the method outlined above, they would have the ability to pay it, for the price of the product sold would be somewhat higher but more nearly in line with the price charged by the privately-owned companies, and this would permit the healthy development of private business and should not be harmful to the co-op, for then they would be operating under more or less the same tax burden.

Equalizing the selling price of the product of the co-op and of the private company would bring about more fair competition, would encourage people to put more money into private business, and would help to attain the goal we are striving for—to have all business grow and expand, giving employment to all, and giving us a national income of one hundred and twenty billion dollars a year.

The things I have said about the electric co-ops are equally true with reference to government-owned concerns in all business fields; they should be made to pay on the gross business done in about the same proportion as private companies in the same business are now paying. Government-owned electric utilities can finance themselves by direct loans from government or by advances from government or by using the credit of government to sell low interest bonds. They can reduce the price of the product sold so that they do not have net earnings after paying operating costs, low interest charges on their borrowed money, and amortization charges. The usual tax laws, therefore, do not apply in full measure for this kind of a business which does not have to establish credit from the business itself but can use the credit of the government in borrowing money.

There is no reason why people served by a government-owned electric utility should entirely escape paying taxes to their government as a part of their electric bills while the same kind of customers in the same kind of a community near by, getting the same type of service over the same kind of lines, are contributing approximately 25 per cent of their total electric bills to the support of their government. There isn't any fair reason why the people in one community should not contribute to the support of government just because the utility which serves them is owned by a municipality, while the people in the neighboring town should pay 25 per cent of their electric bill to the support of the government because they are served by a private company.

All users of electric service should contribute to the support of their government on an equal basis in proportion to the amount used, regardless of whether they get this service from a private company, a co-op, or a government-owned utility. Here again, I am using as an example the electric utility business, but I am sure that a similar situation exists in hundreds of lines of business through this country; and unless something is done to equalize the tax load, you will see more and more private business becoming co-ops or government-owned. You will see private business shrinking in size instead of expanding; you will see the business done in this country by private business taken over more and more by co-ops and government-owned concerns, and business not expanding and growing to the extent necessary to reach its goal and keep this country solvent.

It seems to me that it is very important and necessary that the tax laws of this country be modified so that all co-ops and government concerns in business should make substantial payments to the government in the form of taxes. Because of this very nature of these two types of business, because they can, by manipulation, cut their net earnings to a very low amount without injuring their credit, it is important that they be taxed on gross business done if the federal government is to realize its fair proportion of tax money from them.

I, therefore, suggest that, instead of bringing co-ops and government-owned concerns under the regular income tax law, they be made to pay in lieu of income taxes 12 per cent on their gross business, and also be made to pay any other special taxes that may be levied against business. This 12 per cent may not be the right figure. I believe electric utilities of the country pay 15 per cent

(*Continued on Page* 368)

Industrial Lighting is Cornerstone of the Industry's Revenue

By Ralph P. Wagner

Commercial Manager, New York Power and Light Corporation

From a paper presented recently before a Lighting Conference for Utility Power Engineers, at Nela Park, Cleveland

MOST electric utilities have organized their sales forces along similar lines, and as a rule, have separated their lighting and power salesmen into separate groups. The average power man is probably judged more by the kilowatts of connected horsepower he produces than he is by the relatively small kw of industrial lighting which is installed in the factories he serves. Too often the power salesman has spent much of his time in preparing a monthly report which is little more than an inventory of the motors customers would have added even if he had not called. Had the power man spent more of his time in convincing the manufacturer of the advisability of lighting his manufacturing space properly, then the utility's net revenue would have benefited to a far greater extent than from the reports, which are probably now reposing in some dusty file.

Suppose we analyze the four classifications of utility revenue, industrial, residential, commercial and municipal, and try to determine the bearing of one section upon the other, or I might ask each of you which one of these four categories is most important. I'm sure, after a few moments of study and reflection, you would agree that:

1. The people employed in industry make up the bulk of the residential group.

2. The residential customers support the commercial activity.

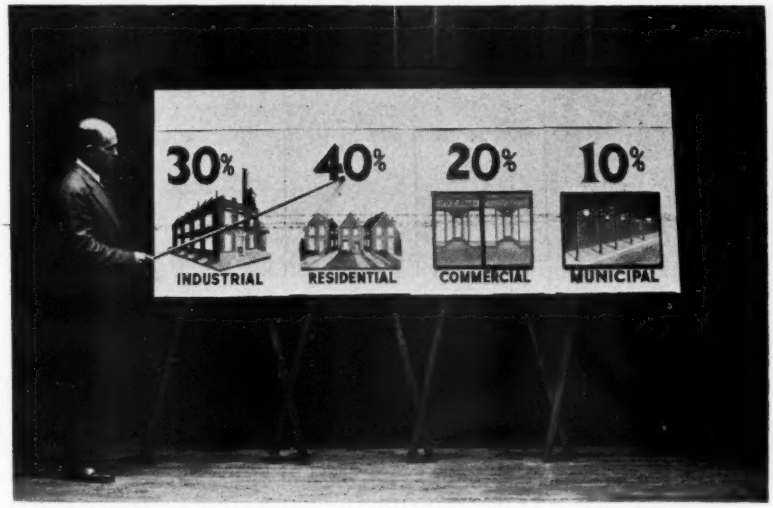
3. The municipal load results from the fact that industry has created a community.

Thus, without industry—residential, commercial and municipal loads would shrink into insignificance, if not disappear entirely.

If you are in agreement with me, I am sure you will readily agree that the foregoing analysis proves the importance of the industrial load. Actually, therefore, industrial load is the foundation of any successful electric utility.

Let me emphasize further the value of the industrial customer. Each time we consider the potential value of an industrial plant to our company, we immediately (note the chart) are forced to recognize that for the 30 per cent of our total revenue coming from industry, 70 per cent comes from the residential, commercial and municipal field. To convert this into dollars means that for each $30,000 of industrial revenue, we get an additional $70,000 from the residential, commercial and municipal classes. Hence, every $30,000 worth of industrial revenue should be looked upon as a $100,000 total potential load. Here then, we come face to face with the real problem—how to protect our industrial load and thereby protect our total business in the community.

You now are probably convinced that the answer is the industrial power engineer, but let's study this picture a little further.



Mr. Wagner shows that over a period of time the residential, commercial and municipal loads all depend upon industry. Good industrial lighting is the key to the productive life of the community which in turn protects the utility's investment in other sources of revenue.

WHERE *the* KILOWATT-HOURS GO
And
WHERE *the* REVENUE COMES FROM

	% Kw.-Hrs.	% Revenue
Industrial	54	30
Residential	22	40
Commercial	14	20
Municipal	10	10
	100%	100%

If we all agree that a successful utility means successful industrial plants in the community, then we must determine what makes an industry successful.

A successful industry must first of all turn out a high grade attractive, useful product which can take its place in the competitive field and sell in an increasing volume. In order to do this, manufacturing costs must be in line so the selling price can be fair and reasonable. Manufacturing costs can only be kept in line if maximum employee production efficiency is maintained, and this can only be accomplished with a happy, healthy employee attitude, in clean, bright, pleasant surroundings. Next, the percentage of rejects must be held to an absolute minimum. How can all this be done? The answer, in part at least, should be quite evident . . . industrial lighting. Good lighting at the inspection bench will help to pick out all the rejects, but good lighting in the plant will help reduce the number of rejects so that the trouble can be remedied at

Black light reveals the alternative Mr. Wagner sees if our industrial lighting is not maintained. As this revenue recedes a much larger loss is reflected in the total revenue, and a busy town becomes a ghost town.

the source, where the parts are made.

The answer to the question of "how to protect our business by protecting our industries" is to sell industrial lighting, not just *some* industrial lighting, not just *good* industrial lighting, not just *average* industrial lighting, but Productive Industrial Lighting, sufficient to put that plant into successful competition. If it were never true before, that a manufacturer had to operate his business as a science, it is true today and will be especially true in the postwar period because competition will be most severe.

Referring to our chart: for each $30,000 of industrial revenue, we see $100,000 of total revenue depends upon it. If approximately 14 per cent of the industrial revenue is industrial lighting, or let us say, $5,000, then it follows that selling, and keeping that $5,000 worth of industrial lighting sold, means protecting $100,000 of gross business.

Our chart is intended to indicate a thriving industrial community. The four sources of utility revenue—industrial, residential, commercial and municipal—are each interdependent upon the others. It is the community's industry which provides employment, payroll and taxes, that vitally affect the living conditions of the people who live there, and as the industry prospers, so do the employees who work in the industry and so does the utility prosper from the residential load obtained from those employees' homes.

Stores, too, are dependent basically upon industry. For as the industry's payroll increases, more money finds its way to the hands of the community's merchants and the utility's commercial load is, therefore, enhanced.

A thriving community of this type, with increases in population, due to increased employment, and with construction of new homes in suburban areas, means that street lighting, too, must keep pace with this expansion and schools and public buildings must be enlarged to meet the community's needs.

However, let's go back to our industry again. Suppose that, due to improper lighting in their manufacturing areas, production errors increased and there was more spoilage. Manufacturing costs, therefore, would rise and either the industry would be faced with the prospect of a reduced profit on the merchandise which they had for sale or else a rise in sales cost which would not allow them to meet competition. In either case, whether the profits are reduced or whether sales volume is depleted, this industry would not find the market for its products necessary to keep it at full and expanding operation. Some portions of the production line would, of necessity, have to be shut down and immediately the utility would not only lose the industrial lighting load which was the original offender, but the industrial power load as well. This loss in industrial power revenue might easily be six to seven times the loss in lighting revenue. Due to shutting down of the production line, men would be thrown out of employment, and if unable to find other work within the community, they would leave their homes for other manufacturing areas. The utility's residential load would suffer in direct proportion to the number of unemployed. The income of the community's merchants would, of course, drop and they in turn would have to retrench and the commercial load of the utility would suffer in accordance.

The operation of street lighting and schools and other municipal offices would be curtailed as well. Industrial lighting, therefore, is the cornerstone around which the entire revenue of the utility is built.

It is no more logical to expect that a good power man should be a good lighting man than to expect a good lighting man to be a good power man. The contact of our industrial customers, therefore, is necessarily a teamwork proposition between the power man and the lighting man. Because the power man is normally given the responsibility of the industrial customers' contact, it is our responsibility to see that he is given the opportunity to actively recognize production lighting needs when he sees them. It is not his responsibility, nor can it be expected of him, to solve his industrial customers' lighting problems. Just as the lighting man, in his commercial contacts, should call on the experience of the power engineer for solutions to air conditioning and ventilation needs of retail stores he contacts, so should the power man recognize the lighting needs of the production line in his plants and call on the lighting man for proper solution of those needs. Anyone can suggest methods to increase the footcandle intensity for any industrial area, but unless the new lighting system installed provides the proper quality and direction of light to increase production or reduce accidents or errors, neither the customer nor, in the long run, the utility, will benefit by the change.

Adequate industrial lighting which will aid in increasing production, reducing errors or spoilage and aid in the protection of the health and safety of the factory employees, produces utility revenue far in excess of the mere lighting kwhr which the industrial lighting installation consumes. There is no other one place on the utility's lines where so little effort on the part of the power engineer can produce such far-reaching results.

Testimony on Behalf of Electric Utilities at F.C.C. Hearing to Review Radio Frequency Allocations

On September 28 the Federal Communications Commission opened a hearing on radio frequency allocations (Docket No. 6651) for the following purposes.

"1. Determining the present and future needs of the various classes of non-governmental services for frequencies in the radio spectrum from 10 kilocycles to 30,000,000 kilocycles with the view of ultimately assigning bands of frequencies to such services;

"2. Securing for the public and the Commission a clear understanding of the conflicting problems which confront the industry and the regulatory body in the application of frequencies to the service of the public;

"3. Encouraging experimentation along such lines as may be justified from the evidence presented at the hearing;

"4. Considering the allocation of frequencies to be proposed by the Radio Technical Planning Board;

"5. Considering the proposed allocation of the Interdepartmental Radio Advisory Committee dated June 15, 1944, in so far as it pertains to allocations to non-governmental services; and to obtain full information as to what recommendations the Commission should make to the Interdepartmental Radio Advisory Committee with respect to possible conflicts between the requirements of the non-governmental radio services and the proposed interdepartmental Radio Advisory Committee allocations to the Government radio services;

"6. Assisting the Government in its preparation for future International Conferences;

"7. Determining what recommendations, if any, the Commission should make to the Congress for the enactment of additional legislation on the matters covered by this order."

Prior to the start of the hearing the Commission announced a tentative schedule indicating the order in which the various services would be considered. This covered the period from September 28 through October 31, with provision for an additional period starting November 1 to consider an overall plan of allocation. It was also announced that for each service testimony would be received first from representatives of the appropriate Panel and Committee of the Radio Technical Planning Board,* following which other interested parties would be heard.

The electric utility case was presented October 21 under the auspices of Panel 13 Committee 4 on Power Utilities. An introductory statement by Chairman of Committee 4, R. V. Dondanville of the Commonwealth Edison Company, was followed by the testimony for the electric utilities by G. H. Underhill of the Central Hudson Gas and Electric Company. These two statements are reproduced herein. Statements by C. T. Malloy, Southern California Edison Company, describing particularly the need for frequencies in the 2-6 mc region, and by P. H. Chase of the Philadelphia Electric Company in behalf of the EEI and the AEIC will appear in a subsequent issue of the BULLETIN. The Committee 4 presentation also included testimony by W. T. Bulla and C. F. Meyerherm in behalf of the gas utilities and water utilities respectively.

Considering the comprehensive nature of this hearing and the indication that among other purposes it is preparatory to future international conferences it appears considerable time may elapse before any final action will be taken on new frequency allocations. In the meantime there has been no indication that the Commission would not continue to consider new applications from electric utility companies for the use of radio under the Special Emergency regulations.

* See September, 1944, issue of E.E.I. BULLETIN, page 292, for discussion of electric utility participation in RTPB.

INTRODUCTORY TESTIMONY

RELATIVE TO THE APPLICATION FOR RADIO CHANNEL ALLOCATIONS BY THE ELECTRIC, GAS AND WATER INDUSTRIES THROUGH COMMITTEE FOUR OF PANEL THIRTEEN OF THE RADIO TECHNICAL PLANNING BOARD

Presented by R. V. Dondanville

Chairman, Committee 4 (Power Utilities)—Panel 13, Radio Technical Planning Board

At the September 28th, 1944 Hearings, Docket 6651 of the Federal Communications Commission, Washington, D. C.

COMMITTEE 4 is unique among the nine committees of Panel 13 of the Radio Technical Planning Board in that its membership and operations cover four basic utility industries: Electric, Gas, Water and Steam. This combination of varied interests which is reflected in the Committee title of "Power Utilities" was developed by the Committee in response to the request of the Panel Chairman for simplification in the Panel organization. It is entirely logical if the three classifications of Communication, Transportation and Power be recognized as representing the basic public utility groups.

The Electric, Gas, Water and Steam Utilities have many similarities. They all operate either under public franchise and regulation, or directly as governmental agencies, and in many cases two or more services are operated under one management. They each deliver an essential commodity directly to the premises of millions of individuals and businesses. They must do this instantly and continuously at the option of the user, and for that purpose have constructed vast distributing systems which occupy the public streets and highways of the nation. Their operating personnel are on continuous 24-hour duty each day of the year and their maintenance crews are likewise subject to instant call for service at any point on the far-flung systems. Such vigilance is necessary both to insure service continuity and because the commodities supplied are all capable of inflicting injury, death, and serious property damage if uncontrolled.

These common conditions have

created a common need for a prompt and reliable means of emergency communication, both between major system control points and between control headquarters and mobile crews. An emergency communication service should function during each and every emergency. If its availability and performance are not of a high order it does not fulfill the purpose for which it was created. The emergencies which occur on Power Utility systems are usually of such nature that immediate action is necessary. Serious emergencies frequently require almost continuous use of the equipment for hours, rather than for minutes. A clear channel within the service range is the only solution believed capable of providing the high priority service required.

It is true that for a large portion of the time it might be possible for two or more services to occupy a single channel in the same area because minor emergenies may not occur simultaneously on the several systems. However, serious emergencies usually involve most, if not all, of the services locally using emergency radio. Separate channels are essential if all services are to function simultaneously. Much more than temporary inconvenience or delay in completing the call is involved in these cases.

The Committee believes the pooling and sharing of channels by the four Power groups, whose specific assignments may be geographically separated, to be practical. Such pooling will permit advantage to be taken of a diversity of need in particular areas and an overall conservation of channels will result. This diversity was recognized in determining the channel requirements of the Power Utility Group. The total channels requested represent approximately 75 per cent of the undiversified requests of the Electric, Gas and Water Utilities when considered individually. This factor represents the combined judgment of the members of Committee 4. It is based upon the belief that unusual local requirements of the three groups will not coincide and its validity remains to be established by actual experience. Committee 4 believes, however, that further expansion of this grouping to include other services of a fundamentally different character would be undesirable and productive of no further advantage.

Committee Four is made up of 20 members and five observers representing both individual companies and the four major trade organizations in the Power Utility Group, viz.: the Edison Electric Institute, the Association of Edison Illuminating Companies, the American Gas Association, and the American Water Works Association. The Committee has considered the needs and plans of both publicly and privately owned organizations and through its geographically diversified membership and extensive correspondence has developed and presented to Panel 13 a comprehensive and nationwide representation of the Power Utilities' radio communication needs, usage and requirements.

With this explanation I offer in evidence the report No. 4 of Committee Four to Panel 13 dated Sept. 11, 1944, identified by RTPB as Document P13-C4-458A. The report covers only the findings and requests of the Committee. It does not contain minutes of committee meetings, preliminary reports or other working material used by the Committee.

Since this report is the composite work of three of the four groups which constitute the Committee—the Steam Group having been inactive to date—the detailed needs and requests of each group will be presented by its individual representatives.

In summation of their collective work I shall read the following brief summary taken directly from Committee Four's report:

The Power Utilities of the United States are engaged in supplying water, gas and electricity to a nation of 135,000,000 people. These three commodities contribute so largely to the people's welfare that modern community life could not exist without them. Their contribution is continuous and their loss is felt by the individual more quickly and more keenly than that of any other service.

Paradoxically, these same three commodities which are so essential are capable of causing severe damage and loss of life should any link in the vast systems which have been constructed for their production, transmission and distribution, fail in its appointed purpose. The prevention and immediate correction of supply system failures is therefore a paramount obligation of the Power Utilities. Continuous vigilance is essential to that end and in the exercise thereof the Power Utilities have a distinct need for radio communication. Their increasing use of radio communication testifies to its effectiveness in the Public Service.

To date the Power Utilities' use of Radio has been restricted by FCC regulations to corrective situations. Radio has such broad preventive possibilities that such restriction has retarded its fullest development in the public interest. The Power Utilities desire to proceed with that development.

Prior to 1930 the Power Utilities' use of radio was confined to the two special emergency frequencies of 2726 and 3190 KC. Less than 25 stations were licensed for such operation.

Following experimental work in the early 1930's the Electric Group appeared before the FCC in 1936 and requested the allocation of sixteen channels for its exclusive use on the basis of demonstrated need for the protection of life and property and for the public safety.

Today, 17 channels are shared by some 15 or more services qualified as special emergency. Of some 1300 special emergency stations now operating, the Power Utilities operate over 800 or between 60 and 65% of the total.

This expansion in actual use has developed on a technically and economically sound basis and constitutes not only a justification of the 1936 requests and commitments, but also the fundamental support for the present requirements.

Special emergency operation is an *established* service within the Power Utility Industry.

Based upon a detailed review of the present and probable post-war situation and uses, and a study of propagation and interference problems in typical, classified areas, the Power Utilities estimate their needs to be as follows:

MF region	(0.3 — 3.0 MC)	3	channels
HF "	(3 — 30 MC)	3	"
VHF "	(30 — 300 MC)	53	"
UHF "	(300 — 3000 MG)	20	"
		79	

For economic reasons the retention of heavily occupied channels is desired. Additional preferences are as follows:

MF & HF channels should be located in the 2-6 MC band and should be sufficiently separated to permit simultaneous use of all frequencies in the same locality. All MF & HF channels should be available for fixed, land portable, portable mobile, mobile and harbor service.

Approximately half the VHF and UHF channels should be grouped in pairs with not more than six nor less than two intervening channels assigned to other services. One channel from each pair should be restricted to mobile, portable and harbor service. The other should be available for fixed, land portable, portable mobile, mobile and harbor service.

The above requirements are in terms of usable channels. Experience with pre-war equipment indicates that the existing center separations do not permit satisfactory operation on adjacent channels of stations in the same locality. The Power Utilities are ready to cooperate in the reduction of channel separations as rapidly as the technical development permits, but believe that the geographical separation of stations operating in adjacent channels will not only continue to be generally desirable, but in many cases necessary.

For all frequencies, A1, A2, A3, and A4 types of emission are requested. For the very high and ultra high frequencies, A3 Special Emission is also requested.

Present tolerances are reasonable and the Power Utilities will cooperate in their observance and reduction as rapidly as technical developments permit.

The licensed power should not be greater than that required for satisfactory operation in the specific instance.

FCC Rule 10.231 states that "Special emergency stations may be used only during an emergency jeopardizing life, public safety, or important property . . ." This rule is unduly restrictive and should be modified to permit the use of radio for Power Utility operations essential to the effective rendition of service regardless of whether

an emergency exists or not. Such use would perform a definite preventive function and, properly controlled, would not require additional channel allocations. Since severe emergencies invariably involve several services the Power Utilities believe that the joint use of special emergency channels by several services is productive of severe interference when communication is most vital. For the same reason, any General Vehicular Service which might be established would not appear to provide the top priority service demanded by Power Utility emergencies. Segregation of Power Utility channels is equally as important as that of Police or Fire channels.

With reference to the scope of the service, I wish to emphasize that it is neither requested nor desired that the regulations be relaxed to permit the transmission of other than urgent messages pertaining to essential Power Utility operations. During serious widespread emergencies, such as the recent Atlantic seaboard hurricane, radio facilities must be in practically continuous use for extended periods, possibly days at a time. If channel allocations are adequate to accommodate such situations —as they must be to provide a satisfactory emergency service—then there will be a very large proportion of the time when use could be made of the radio for essential operating orders with fewer interference problems than during the infrequent occasions of major emergencies. Furthermore in the operation of power utilities there are situations where it is difficult to immediately determine the propriety of a message under a strict interpretation of the present regulations. That is, no emergency may actually exist at the time but the probability of an emergency resulting may be great unless prompt action is taken. Definite authorization of such preventive functions would expand the usefulness of radio in the public interest.

It is the considered opinion of Committee Four that the needs of the Power Utilities would be better served if their service were removed from the Commission's "Special Emergency" Classification and placed under a new "Power Utility" section established within the more general "Emergency Service" Classification.

In conclusion I wish to state that all members of Committee Four have been keenly aware of the necessity for keeping the channel requirements of their individual services to a minimum consistent with future necessities. This need has been observed both in setting up the individual industry requirements and in preparing a combined and diversified request for the Power Utilities as a group. As further evidence of this recognition I wish to express the desire of all the Power Utilities to continue to participate in the cooperative efforts of both Government and Industry to the end that a workable solution to this complex problem may be found.

GENERAL AND TECHNICAL TESTIMONY

RELATIVE TO THE APPLICATION OF THE ELECTRIC LIGHT AND POWER INDUSTRY FOR CHANNEL ALLOCATIONS THROUGH COMMITTEE FOUR OF PANEL THIRTEEN OF THE RADIO TECHNICAL PLANNING BOARD

Presented by G. H. Underhill

Member, Electric Utility Group, Committee 4—Panel 13 Radio Technical Planning Board

At the September 28th, 1944 Hearing Docket, 6651 of Federal Communications Commission, Washington, D. C.

I shall present the requests of the Electric Light and Power Industry which is one of the three major groups constituting the Power Utilities as considered by Committee Four of RTPB Panel 13. In this presentation I shall treat such requests as though that Industry were independent of the other groups. It is to be understood however that the Electric Power Utilities concur in the joint recommendations of C4P13, as presented by Mr. Dondanville.

* * *

EMERGENCY RADIO as used by the Electric Power Utilities serves the public in an indirect manner. To understand how it performs this function, it is necessary to know a few salient facts about the Electric Power Industry, its historical development, the importance of its service to the public, and its methods of operation. With this background the industry's need for radio service and the extent to which it has supplied those needs may be better appreciated.

The Electric Light and Power Industry is composed of some 3500 companies (both public and private) which are engaged in rendering electric service to some 100 million users throughout the United States. Over 12 billion dollars has been invested in the utility plant necessary for such service and nearly 2 million circuit miles of transmission and distribution lines are utilized to deliver the output of 48 million kilowatts of electric generators. Approximately ¼ million people and 60 thousand motor vehicles are employed to operate this system which must function continuously to supply what has come to be the very life blood of the modern community.

The importance of electric power to industry, particularly during war times, has been adequately demonstrated many times and is today so well recognized that reiteration of the record here is unnecessary. Acceptance of electric service by the general public has been equally as thorough but perhaps not so fully appreciated. Yet no other public service affects the activities of the individual more intimately. The average person does not stop to consider that his amusements, comforts, transportation, food, safety and perhaps very existence depend upon electric service. It takes a hurricane such as that of 1938 or 1944 to remind people that their lights, their broadcast and television receivers, their oil burners, their washing machines, their refrigerators, their ranges, water pumps, brooders, milking machines, etc., may suddenly become useless. Even then they may be completely unaware that more serious community hazards may have been created. Hospital equipment, fire, water and sewage pumps, street and traffic lights, tunnel ventilating fans, food refrigeration, milk pasteurization, street and subway cars, telephones, and a host of other services may have been affected. Collectively these make modern community life possible and all are largely if not wholly dependent upon electric service.

This present dependence upon electric service is nation-wide and has resulted partly from the public's acceptance of electric service as a convenient and cheap source of light and power and partly from the increased availability of such service in consequence of an unprece-

dented expansion in generating facilities, transmission interconnections, and distribution networks.

Prior to 1900, technical limitations generally restricted electric systems to the heavily populated areas. Systems were independent of each other, distances were short, and control was comparatively simple. Rapid improvement in the technique of power transmission during the next 20 years made it practical and economical to develop remote sources of power and to interconnect many important and previously isolated urban load centers.

More recently, there has been an accelerated extension of electric distribution lines into rural areas never before served. As an indication of the extent of this trend, statistics show that the number of farms supplied with electric service has increased 260 per cent in the past 10 years.

This expansion and general acceptance of electric service has placed an increasing premium upon service reliability and has stimulated the further study of methods for improving such reliability by both preventive and curative means.

In the earlier years the need was for better control of the operation of widely separated generating and substation units of ever-increasing size. Prompt communication of the utmost reliability is essential to such control, for electric power cannot be stored and any irregularities in its flow are instantly felt at all points in the supply system. Loads vary constantly in response to customer demands, and generating units must be governed accordingly. Voltage and power-factor of both generating units and interconnecting lines must be closely controlled, and frequency must be accurately maintained. Frequent and numerous switching operations at widely separated points are involved in the control process and for the further purpose of inspection and maintenance of vital equipment. In times of trouble, prompt execution of switching orders may be the only means of avoiding a serious interruption to important industry and community services.

More recently the expansion of distribution facilities just mentioned broadened the overall exposure of the system to storms and accidents and thereby increased the probability of scattered trouble. This raised a different type of control problem, namely, the effective direction of the personnel required to keep an ever-expanding physical system in a high state of operating efficiency. The industry had always provided expert mobile crews for this purpose but they had not previously been called upon to cover so large an area, to so closely coordinate the timing of operations, nor to maintain so close a contact with headquarters. These mobile crews constitute the first line of defense against the many emergencies which continually occur in electric power utility operations. The more serious of these emergencies arise from natural causes which may vary from serious hurricanes, floods, earthquakes and forest fires to local storms where wind, ice and lightning are the most troublesome elements. Lesser emergencies may be caused by the mechanical or electrical failure of materials or equipment, either as a result of deterioration or of foreign interference such as stone and gun shot damage, fires, felling of trees across lines, breakage of poles by vehicles, damage due to construction operations, etc., etc. As a matter of fact, any abnormal condition in an electric power system is a potential emergency, for it may constitute or develop into a situation where vital services are interrupted and hazards to the traveling public and to persons and property in the immediate vicinity of the trouble are created. These conditions may arise at any point on the system and must be corrected promptly if serious consequences are to be avoided or minimized. Here again, prompt and reliable communication is essential, but in this instance it is required between headquarters and field crews rather than between fixed points.

This brief description of power system operations brings out the fact that the Electric Power Utilities are heavily dependent upon adequate and reliable means of rapid communication of two distinct types.

In the case of system operation or load dispatching, as it is sometimes called, the need for point-to-point contact is clear. Many kinds of wire lines have long been used for this service, but all have been found to be more susceptible to failure as a result of storms and accidents than are the power circuits themselves. To overcome this recognized fault, carrier communication systems have been developed and are today widely used. However, power circuits are only relatively more immune to trouble than communication circuits and they do not have to fail to disrupt carrier communication. Circuit cutouts and ice formations not infrequently cause serious impairment or complete loss of the channel without adversely affecting the power circuit. The Electric Power Utilities' earliest use of radio arose as a result of the unsatisfactory performance of wire line communication between system control points during severe storms when it was most needed. They have utilized point-to-point radio for this purpose for over 20 years and plan to continue and expand upon this application.

In the case of mobile crew control, no normal means of communication exists, yet the need for it may be even greater than in system operation. Emergencies arising on the transmission and distribution system can only be met by prompt and effective action on the part of the crew dispatcher at headquarters. He in turn is completely dependent upon some means of contact with all crews under his supervision. On an extensive modern system, normal construction and maintenance work requires that crews work at many scattered points in the territory. These are frequently remote from telephone facilities and often from 20 to 100 miles or more from the crew's base. When word of some emergency is received—and that word usually comes either from a central control point where disturbances or service interruptions have been noted, or by telephone from the general public—a crew must be promptly dispatched and time (perhaps vital) can be saved if the nearest available crew can be selected. During night hours when local telephone facilities are not available the location of a crew by messenger may prove necessary with consequent loss of time. After a crew has been located and has arrived at the scene it must immediately report back as to the nature and extent of the trouble, its own ability to handle the situation promptly and adequately, or the need for additional material and help. The latter is often the case and additional crews must then be located and dispatched. In serious cases the crew first on the scene must remain there for the protection of the traveling public and if the point is remote from telephone facilities valuable time may be lost because of the necessity for dispatching a messenger — often without adequate means of transportation—for additional

help. Frequently, several crews must work together in patrolling and switching long sections of line in order to find or isolate the trouble and to maintain service over other routes. Constant communication between crews is essential in this second phase of trouble work. When severe storms result in many cases of simultaneous trouble, the dispatchers' work becomes seriously complicated by the fact that normal telephone facilities are either out of service or severely congested by a flood of calls from the general public. This situation may easily result in the prolongation of public hazards, unnecessary interruptions or delayed restoration of electric service to important users or communities.

When mobile radio service first became available, it appeared to offer a practical solution to the problem and during the early 1930's several experimental installations were made by the Electric Power Utilities. As a result of this work, representatives of the Edison Electric Institute appeared at the 1936 Allocation Hearing and requested the Commission to allocate channels which would permit the further development of this type of service. Testimony presented at that hearing included a statement that some 30 electric companies had signified their intention to utilize radio if suitable frequency allocations were made available. (See Exhibit 4.9.) The Commission recognized the need for such service in the interest of public safety and allocated a number of shared channels to the Special Emergency Services in addition to those previously available. In the succeeding four years prior to Pearl Harbor the Electric Power Utilities proceeded to develop emergency radio communication service far beyond their 1936 expectations.

Present Usage of Radio

Today some 50 Electric Light and Power Companies in all parts of the country are actively using emergency radio communication systems. These companies operate approximately 750 transmitters or well over half of all those at present licensed for Special Emergency Service.

The fact that these Electric Power Utilities have adopted and expanded emergency radio communication systems as part of their program for rendering adequate and continuous electric service to the public is of itself evidence of both the need for and the importance of such systems in that service.

In the MF and HF regions (0.3-30 MC) operations are restricted to four frequencies between 2 and 5 MC. Use of these frequencies which are occupied by some 110 transmitters is largely confined to situations where the distances or topography involved make the use of higher frequencies impractical.

In the VHF region (30-300 MC) present operations are largely confined to the 10 available frequencies in the 30-40 MC band where they provide a mobile service of both single and two frequency types. The latter is sometimes modified to provide three-way service wherein the mobile unit may be switched from the mobile to the fixed frequency for communication with other mobile units. To a limited extent these frequencies also provide point-to-point and repeater station service.

Slight use has been made of the frequencies available above 100 MC and no use of frequencies above 150 MC.

All operations are being conducted in accordance with F.C.C. Rule 10.231 and are directed exclusively at the improvement of public safety during times of accident and disaster and the prompt restoration of electric service to important industries and community services following interruptions thereto. This usage of emergency radio communication service produces no direct revenue but rather is a material expense which ceases to be justifiable as soon as the public ceases to benefit therefrom. Simply because the public does not participate directly in its use, as it does in the case of radio facilities dedicated to amusement and educational purposes, does not alter the fact that the public is the principal beneficiary. In this respect Electric Power Utility radio may be placed in the same category as that of the Police, Fire, or Forestry Services. It is a matter of record that a close cooperation and coordination today exists between the police, fire and electric utilities in their respective use of radio. Rarely does a serious emergency arise in which more than one of these services are not involved and where mutual assistance is not rendered through the fact that radio is available to and often used by all services.

To illustrate the kind of service rendered by emergency radio, Exhibit 4.7 of Committee 4's report to Panel 13 was prepared. Companies "a" through "l" in that exhibit are Electric Power Utilities. The exhibit speaks for itself and I shall not take time to read any part of it. I do wish, however, to present a brief summary-digest of the cases occurring on the system of one Electric Power Company which operates in a large midwestern city. During eight months of 1944, 524 emergency cases, involving services to important customers or hazards to the public, occurred in which radio communication was used to great advantage. There were:

158 cases where service to war industries was interrupted.
90 cases where high voltage wires were down and a serious public hazard created.
86 cases where wires interfered with fire department operations.
64 cases of poles broken off by vehicles.
12 cases where broken wires interrupted service to large areas.
3 cases of interruption of service to public water and sewer pumps.
1 case of interruption of service to a hospital, and
110 cases of lesser importance.

This tabulation of one company's operations clearly indicates that major emergencies such as those caused by hurricanes, floods, etc., constitute only a small fraction of the total. These obviously provide occasion for the more spectacular use of radio facilities, but collectively the lesser and more numerous incidents result in an equal if not greater contribution by emergency radio to the public safety and welfare. These less serious cases arise with practically every local storm and from numerous other sources. The resulting conditions, while local in extent, require just as prompt corrections as those affecting larger areas, for they may have just as serious consequences upon the people and customers involved.

Future Needs

During the past four years, war conditions have greatly restricted the installation of radio facilities by Electric Power Utilities. Late in 1942, construction permits for some 120 stations were pending, and returns from a limited survey of the industry's post-war plans undertaken last May indicate a much larger potential demand today. These returns, which are presented in detail as Exhibit 4.3 and in summary as Exhibit 4.1, indicate that 73 of the Electric Power Utilities canvassed (representing approximately 50 per cent of the industry) expect to have more than 3300 transmitters in operation within five years after the war. This is exclusive of those which may be installed by companies not canvassed which might increase the figure to perhaps 4000. This figure compares with approximately 750

now operating. This increase of some 350 to 450 per cent will occur principally in the mobile service and on frequencies above 30 MC.

In developing the details of the technical requirements necessary to accommodate this expansion certain new uses have also been considered. These are as follows:

A. The automatic relaying of transmissions for the purpose of range extension or to overcome the shadow effect of intervening obstructions.

B. The performance of Power System operations such as the control of remotely located apparatus where other means of operation are inadequate or non-existent.

C. The automatic transmission of metering or alarm signals vital to the proper operation of power system facilities, in the absence or inadequacy of other means of transmission.

D. The more effective direction and conduct of complex field operations which require close coordination of functions at separated points within a localized area. Walkie-talkie or handy-talkie units are contemplated for this service.

The first of these new uses arises from conditions specific to the radio communication system itself. The need for transmitter control and repeater links has been demonstrated by several services and it is essential that these be provided for if the fullest use is to be made of the system under adverse topographical conditions.

The next two uses arise from needs within the electric power system itself. As previously discussed, the extensive growth in size and geographical expansion of such systems during the past 10 to 15 years has complicated the adequate control of the many power system units located at distant and sometimes inaccessible points. In some instances such control is required to insure an uninterrupted flow of power, and in others it is necessary to prevent serious injury or property damage in the event of failure of the power facilities. The usual communication facilities have not proven to be sufficiently reliable under all conditions to meet these increasingly rigid requirements. It is a fact that the storms which are the most frequent cause of such failure usually disrupt the control or communication circuits *before* they damage the power circuits. In other situations the distances or topography make impracticable the installation or maintenance of wire line control circuits. There is need for a means of controlling power equipment which will prove reliable under the most adverse conditions.

Beamed radio control appears to offer a feasible solution and one possibility being considered involves the multiple use of the radio channel for simultaneous transmission of voice and coded control impulses. A very general description of this system, which is simply illustrative of the possibilities, is given in Committee 4's report (see also Exhibit 4.45). Details have not been worked out but as now contemplated it would operate on frequencies above 300 MC in a manner similar to a two-way, four-frequency relay link.

The final new use listed, in reality is not new, for some electric power companies have used two-way portable sets to a limited extent in the past. However, the war has brought about such an expansion of this application and has developed the required apparatus to such a high level that there is no doubt of a material post-war expansion in the Electric Power Utility field.

There are two major applications. The first and most important may be considered as a small scale development of the present mobile service. Most electric power system emergencies require the inspection or operation of equipment located at scattered points often some distance from the trouble. To handle such situations the crews are frequently broken up and task groups of one or more men given individual assignments. Coordination of these scattered operations is essential to avoid accidental energizing of power circuits with perhaps fatal results, and the use of portable radios of the walkie-talkie or handie-talkie type promises to materially speed up the removal of public hazards and the restoration of electric service to important customers such as hospitals, municipal agencies, and major industries.

The second application for portable radio is essentially non-emergency in character. It arises from a need for localized communication on extensive construction projects and in normal operations where ordinary means of communication are not available. These situations frequently involve communication over water.

Technical Requirements

General

The radio communication systems used today by the Electric Power Utilities are not experimental projects and the attention of all licensees is being directed to application problems rather than to apparatus and system design and specification. They are therefore unable to provide reliable, quantitative data as to usable field strengths, noise ratios, and similar technical information desired by the Commission. Supplementing the following general statements relative to such matters the Electric Power Utilities wish to express both a desire to cooperate with radio equipment manufacturers and the Commission in the collection of any such data required, and a willingness to modify their general specifications as frequently as necessary to keep pace with technological advancements.

Channels Required

The Electric Power Utilities estimate that 51 channels will be needed to adequately meet the contemplated post-war expansion of their emergency radio services. This estimate is based upon past experience, present practices, and studies of possible future developments in extensive mountainous, metropolitan and industrial areas.

These requirements may be subdivided as in the table below.

Four channels in the 2-6 MC region are the minimum necessary to provide complementary day and night telegraph and day and night telephone service in those areas where VHF channels have proved inoperative. These will also provide for a short-range handie-talkie service as previously described. The specific needs for these channels will be discussed in detail by Mr. Malloy.

In the VHF region studies were made of Point-to-Mobile Service in the Cleveland-Pittsburgh and the Greater New York City areas. These two areas were selected as being reasonably representative of the more congested sections of the

Band Designation	*Region Desired*	*Channels Needed All Types of Service*	*Mobile and Portable only*	*Total*
MF	2-3 MC	2	—	2
HF	3-6 MC	2	—	2
VHF	30-40 MC	6	9	15
	100-300 MC	7	7	14
UHF	300-3000 MC	14	4	18
		31	20	51

country and by repeating the pattern there developed it is believed possible to serve the entire country.

These studies were based upon two-frequency operation with half the channels restricted to mobile use. The process used was as follows:

The territory supplied by each electric utility operating in the area was outlined and from the extent of that territory, a knowledge of local topography and past experience with radio operations in these and similar areas, channel assignments were made. This essentially judgment process was aided and substantiated by application of the following general engineering considerations:

Assuming A3 special emission, a basic ratio for desired to undesired signal of 2 to 1 was adopted. To insure the maintenance of this ratio under adverse local transmission conditions a geographical ratio of approximately 4 to 1 between the minimum distance to any undesired transmitter and the maximum distance to the desired transmitter from a mobile unit operating at the edge of the territory was selected. Application of this ratio as a minimum acceptable standard indicated that in both areas studied, 6 fixed frequencies in the 30-40 MC band and 3 fixed frequencies in the 40-300 MC band are the minimum necessary to provide satisfactory service for the companies involved in the area. For two-frequency service these 9 fixed frequencies must be matched with 9 mobile frequencies.

To these 18 fixed and mobile channels have been added three channels in the 30-40 MC region and eight channels (four fixed and four portable) in the 40-300 MC region to cover the fixed point-to-point, repeater, and portable pack set services previously described. There is a definite probability that all these uses will be established during the post-war period. However, it appears inadvisable to attempt the specification of use-restrictions for any of these channels at this time. Further experience should be obtained before point-to-point or mobile or portable limitations are imposed on any of the eight channels requested.

The estimates of the 30-300 MC channel requirements are based upon the best information available as to probable developments within both the electric power and radio industries. They must be considered minimums in that they contain no margin for the solution of the serious problem of sky wave reflection interference at distances in excess of some 500 miles and make no allowance for possible technical developments which are not now known to the Electric Power Utilities, and which might advantageously be used by them.

In the region above 300 MC the Electric Power Utilities have had no experience. They recognize, however, many situations in Power Utility work where the characteristics of these frequencies promise to be of great assistance in solving difficult control problems. Because of the limited range and ease of directional control of these frequencies the Electric Power Utilities believe that a small number of channels will accommodate their probable future needs. It is contemplated that no use will be made of these frequencies for some time following the war. The total of 18 channels representing seven two-frequency relay or point-to-point circuits and four mobile or portable channels is the best estimate of their requirements the Electric Power Utilities are able to make with the limited knowledge and experience at their disposal.

Channel Separation, Arrangement and Use

The channel requirements set forth above have been based upon post-war conditions and represent channels usable at that time. Experience with pre-war equipment indicates that existing center separations do not permit satisfactory operation on adjacent channels in the same locality. Furthermore, the center separations used by Panel 13 in the tentative arrangement of VHF and UHF channels are considered impractical in the light of the limited information available to the Electric Power Utilities. Such separations are acceptable only on the basis that post-war technical developments will permit practical operation at such close limits. Unless such developments are forthcoming, the channel arrangement suggested by Panel 13 will prove to be inadequate and not in conformity with the requests of the Electric Power Utilities.

The present practice of limiting certain frequencies for mobile and portable use only should be continued as the operation of fixed stations on mobile frequencies by any service is considered to be a potential source of interference.

In the 30-40 MC band, the present channels are arranged into a central group of "mobile" frequencies with groups of "fixed and mobile" frequencies on either side. Since the three-way system requires two-frequency operation on a single set of tuned circuits and a single mobile antenna, the two frequencies must be reasonably close together if efficiency is to be maintained. This requirement combined with the large number of single frequency systems in operation has forced a heavy concentration on the two end groups of "fixed and mobile" frequencies, with the result that the center block of "mobile" frequencies is lightly occupied. To permit more efficient operation and a more equitable distribution of stations the Electric Power Utilities request (1) that approximately half of all VHF and UHF channels allocated for their use be grouped in pairs with not more than six nor less than two intervening channels assigned to other services and (2) that one channel of each group be designated as a "mobile" frequency, with the other channel of the group as a "fixed and mobile" frequency.

Frequency Tolerance

Present frequency tolerances are considered reasonable and the Electric Power Utilities will cooperate in their observance and reduction as rapidly as technical developments permit.

Emission

In the majority of their radio operations the Electric Power Utilities plan to use A3 or A3 Special emission. It is essential, however, to provide for A1 and A2 emission both for long range MF and HF operations and for control, telemetering, selective paging and non-selective calling systems on the VHF and UHF channels. These calling systems have proved to be of material assistance in reducing interference by the elimination of repeated incomplete calls. A4 emission is also contemplated as insurance against loss or misinterpretation of transmitted orders. The Electric Power Utilities have had no experience with this service, but request provision therefor on the grounds of anticipated use, when the necessary devices become available.

Power

The licensed power should not be greater than that required for satisfactory operation under the most unfavorable conditions normally to be encountered at the specific installation. Reduction of power during night hours should be required on MF and HF channels only. Whenever practicable, directional antennas should be used as a means of reducing power and interference.

Summary

To sum up this testimony:

It has been shown:

A. That the Electric Power Utilities render a public service which is vital to the safety and welfare of the entire population of the United States,

B. That their need for radio communication as an important aid in the rendering of that service has been clearly demonstrated in

(*Continued on Page* 366)

How We Do It

By C. B. Boulet
Wisconsin Public Service Company, Milwaukee, Wisconsin

Presented at Meeting of EEI Accident Prevention Committee Meeting, New York, Sept. 1-13

I HAVE been asked to summarize the answer to the question: "How did you do it?" I presume I am the victim because our company is one which has had a favorable accident experience over a period of years.

Our program started some 20 odd years ago following two or three bad years with several fatal accidents and a frequency of over 40 lost time injuries per million hours worked. Some of the first steps that were taken in establishing our program might be classed as fortunate accidents in themselves, as we were quite inexperienced and followed a program of trial and error. Perhaps those things which we did accidently with good results should be recorded, but before attempting to do this, I want to emphasize, as I have many times in the past, the *one single most* important factor which has made our program successful. This factor has been the wholehearted, active, energetic support of top management.

This interest has been a standout over the years, and the strong backing of top management would have, in itself, brought about a substantial reduction in our accident rate. This interest has evidenced itself time and again in orders from the president of the company to department heads, division managers, and others in positions of responsibility to the effect that "Accidents Must Stop." No excuses have been acceptable. The position taken has been firm and uncompromising, until today every man in charge of any phase of our operations knows that it is his responsibility to see that safety is a part of every job, every project, every plan, and that he personally will be held accountable for accidents which occur to employees under his jurisdiction.

Further interest in safety has been evidenced by top management through inquiries regarding the accident trend, departmental records, requests for information on serious accidents, authorization of expenditures to reduce hazards, letters of commendation for good records, sponsoring of safety awards, trophies and contests, attendance and talks at employee meetings, and in many other ways.

With this type of managerial backing and support, a safety program cannot help but produce results; without it—well, I wouldn't want the job of safety director. My own feeling is that a bad record should be charged to poor management—a good record should be credited to good management.

One of the first steps taken in the organization of our safety program was the calling of a meeting of some 50 of our key people for a two-day conference. The accident record was reviewed and the proposed safety program outlined. The president of the company emphasized supervisory responsibility to the group, and we started out with fifty enthusiastic supporters of the movement. As I look back, this meeting was one of those fortunate "accidents." It moved our program ahead at least two or three years because it placed responsibility quickly and emphatically with the same men who were responsible for production, service, and maintenance. This whole-hearted backing and support by the supervisory group has been the keystone of the entire program and it has kept the whole effort on a sound practical basis.

I think there you have a summary of the heart of our program—top management's sincere interest, and the assumption of responsibility by the supervisory group of executives. All other features of the program are in a sense, merely tools. To discuss them fully would take a good deal of time, so I am listing a few of them in the order of their importance and summarizing the function and aim of each.

1. Field supervision. We have two full time safety engineers whose responsibility it is to spend time with line crews, servicemen and other outside employees; as well as with production (plant) employees; to supervise work from the safety standpoint; to discuss hazards both as they relate to physical equipment or methods and to advise with supervisors and men on all problems relating to the prevention of accidents. This day-in and day-out supervision is of the utmost importance in maintaining a continuing and undiminishng interest in safety.

2. The monthly safety meeting. Every employee of the company spends at least one hour each month (for which he is paid) in attendance at group safety meetings or conferences. These meetings are in the charge of the department head or superintendent. The conference method of discussion is used. Subjects discussed include rules; practices; new equipment; accidents; specific hazards; violations of rules and practices; protective equipment, etc. The opinions and suggestions of the employees are earnestly sought in these conferences. All suggestions are followed up and subsequent reports made as to their disposal. These meetings serve to bring safety to the attention of every employee in a practical manner. They are indispensable to our program.

3. Safety News Letter. This is a mimeographed monthly publication of nine to 12 pages, which goes to foremen and supervisors monthly. It contains accident reports, discussions of the safety record, information on specific hazards, discussion of seasonal hazards and many matters pertinent to accident prevention. This "letter" serves as a means of giving the men in charge of safety meetings material for their meetings. It has been published monthly on the first of each month for 16 years. The expense is low, the value great.

4. Posters, bulletins, sound slide films, moving pictures. All of these visual means of safety instruction are utilized to the fullest extent. They are a part of every orthodox safety program and we use them constantly and under careful supervision.

5. Foremen's Conferences. Full-day conferences for foremen are a part of our supervisory training program. These conferences are conducted by the personnel department, and accident prevention is given a prominent part in the conference program. This type of training assists the foreman in assuming his full responsibility for those in his charge.

(*Continued on Page* 366)

By What Steps Does a Foreman Assume Responsibility in a Safety Program?

By H. O. Sprinkle
Chairman, Accident Prevention Committee, EEI

FOREMAN responsibility is an old subject. It has been covered countless times by many able writers and speakers, and no doubt every one is thoroughly convinced the foreman is the key to the success of any accident prevention program just as he is the key to the success of any work program. We all subscribe to this general principle, but I question if we have given sufficient thought to the policies and training practices which must accompany this principle if the whole organization and the foreman himself are to thoroughly understand it. By what steps does an organization establish policies and educate its workers and supervisors that the immediate foreman of a crew is the key man.

Let's start with the following set of premises. Most of you will subscribe to them because they are not new.

(a) Accident prevention means safety on the job.

(b) Safety on the job means good working habits.

(c) Good working habits mean job training.

(d) The key person in giving job training is the immediate supervisor of the worker. In fact the training must begin with him.

(e) The foreman is the interpreter of the company to the worker, and of the worker to the company.

If you agree with these premises, think back into your own company programs of accident prevention and job training, and see if the foreman has been consistently built up as the trainer of his men and the interpreter between worker and employer.

Of course we hold him largely responsible for the actions of his crews. He is with them all the time. He must provide the answer for accidents, job performance, tool and equipment maintenance, etc. He must issue praise, criticisms, warnings, reprimands. He must be on the watch for the spells of erratic behavior that strikes every one when their reactions aren't normal. He listens to the troubles and complaints of the men, and must always be ready to transmit and explain company policies as they affect his crew. In short, he is the one and only correct medium for the continuous contact between the worker and management that spells good employe relations and good job performance. And, since safety is a part of all good job performance, it follows that the foreman is almost entirely the key to the success or failure of accident prevention efforts.

Since he holds a place of such prominence in any organization, are we always very, very careful that he is given the training and support necessary to fit him for his work, making him first recognize, then assume, the responsibilities we insist are his.

As I have said before, this is an old story, but so are a lot of things in life. Repetition—endless repetition—is still not enough to keep them in our minds. Have you all learned the following sound pieces of advice until you no longer fail in doing them?

"Brush your teeth every day—see your dentist twice a year."

"Keep your head down and your eye on the ball."

"Always signal for a left turn."

"Watch your step."

Of course you don't do these things consistently, but the more often they are brought to your attention, the more likely you are to remember to do them. In the same line of thought, I don't believe we can be reminded too often to check our company policies and habits to make sure that the foreman is being maintained in his proper position. Bear in mind one important thought:—the foreman himself is not always aware of the conditions which are making it hard for him to do his work well. They are beyond his control, and alert management must see that the conditions are made favorable for him.

I sometimes think we demand too much of a foreman. It is very easy to place the blame on him for some poor job or an accident. In most cases he is partially to blame, but in our own company experience we have found that supervision above the foreman level is almost always to blame in greater or lesser degree. For instance, in our company (and I hope you will pardon the personal reference in this talk, but I can really give you to best advantage only what I have experienced and what I know to be facts)—in our company we have just been through a spell of getting control of accidents in our rights-of-way clearing crews. The only lost time accidents this year in the Operations Department have been in this work. The most serious accidents were occurring in the felling of trees and removing danger timber along existing lines. The same foreman had been doing this work for several years. Why were we growing worse in this activity when all the rest of our substations and line work was improving in safety experience?

We don't know all the answers to this question, but after analyzing the problem we very soon came to one conclusion:—the top supervisors of the department had not given the foremen engaged in this type of work sufficient training and help so that they could do a good job. A major part of the responsibility for those accidents came right back to the department head (which happens to be me). The foremen weren't aware of this deficiency. They knew they were expected to take a gang of men out and do the work. They knew that the head men weren't satisfied with the accident experience. The most important point of the whole situation was that we knew we were getting a poor job from the standpoint of both quantity and quality of production, and all we needed was the accident record to point it out. The foremen didn't appreciate this angle of the matter, and we didn't stress the point too much. But we knew that if these

men had been properly trained for their job they wouldn't be having nearly so many accidents, and we would be getting safer and more and better production.

I would like to comment here on one interesting and gratifying aspect of the work of our department:—as soon as we run up against a problem of poor workmanship or bad accident experience we always, without exception, find that the foremen concerned are able to develop all the good working practices necessary if they are encouraged to do so and are given a chance to pool their ideas. This is, no doubt, just as true on your properties as on ours, but if you haven't drawn on this reservoir of experience you are missing a bet. Anyhow, we got the foremen together and discussed the situation. In a little while those foremen had agreed upon a half dozen improved methods of doing the work which, when put into effect, are already greatly improving the safety of the work as well as the quantity of it. One of the valuable contingent benefits was that these foremen got a very definite impression that their work was important and that the management of the company was interested in them and backing them up.

The point I am trying to bring out here is that we couldn't blame the foremen until we had assumed and properly discharged our responsibility as representing higher levels of supervision. The foreman *is* the key man, and he must assume a great responsibility for the performance of work under his direction, but he must have alert and conscientious supervisors above him who are willing to take on their full responsibility for seeing that he is capable of doing the work assigned him, and then give him the authority necessary to enable him to do the job right.

Another tricky item of responsibility which ties in definitely with safety and good job performance is in the administering of discipline. Disciplinary action includes all the variations from a mild caution or warning up to discharge of the employe. Most companies are jealous of giving the foreman too much leeway in this important matter. Organized labor has usually made it mandatory that disciplinary actions go through certain set routines which deprive the foreman of practically all freedom of action in this regard. Of course we all subscribe to the policy that a man or group of men should be persuaded rather than compelled to a course of action. Maybe there are ways to accomplish this in every case, but history and our own personal experience prove that every once in a while a situation develops which is beyond the realm of persuasion, and nothing but firm action will permit proper work being done.

If your foreman is much restricted in his authority in this regard, how can you hold him responsible for carrying out his work in a proper manner? Just what limitations do you put on your foreman in the exercise of disciplinary powers? Has this situation been analyzed in your particular company so that everyone, including the foreman, knows just about how far he can go and is satisfied with the conditions? These are questions for each company to answer, as it is obviously impossible for me to give any specific answers which will fit all cases.

I believe, however, that there is room for great improvement in most companies in studying this situation and making sure that the foremen know what they can or can not do, and that when they do make a decision they will be supported by management.

As an example of some specific answers to this problem, here is a summary of policies which have proved to be workable.

1. A foreman should not be required to keep in his crew a man whom he feels to be unsafe and incapable of being corrected, at least while under his supervision.

2. A foreman should not be required to keep in his crew a man whose work, in the judgment of the foreman, is so inferior that it makes good job performance quite difficult or impossible.

3. A foreman cannot discharge an employe. He can suspend a man for serious infractions of rules pending an investigation—and later decision, as to what final action will be taken.

4. Job training of the crew is the foreman's responsibility, and every effort should be made to see that it is handled through him.

5. All matters pertaining to changes in payroll status or position for the men in his crew should be handled through the foreman, so that he becomes the representative of management insofar as possible. If he can't handle it alone, at least he should sit in and assist.

In many companies the above five items have been worked out so that a smooth running system results and a good job is obtained. But it is a good bet that in the majority of organizations there is still a lot of uncertainty in some of these matters.

For instance, in your particular company, is it well understood who will handle the various types of crew training, and are your foremen satisfied with such arrangements? Are the training programs studied out in advance so they will enhance the foreman's position with his crew? Or is the personnel department or safety department or some other department or person so eager to show that it or he is running part of the show that they take the play away from the foreman? It is obvious, of course, that some types of training cannot be given adequately by the foreman, but they can always be given such a slant that will help to bolster the foreman's prestige.

The very sensitive matter of wage changes is an important measure of crew control. We all work for pay, and there is nothing that takes the place of having it thoroughly understood that the foreman's recommendation is practically a necessity before a man can get a raise. As a corollary to this, a man may get a demotion or be removed from his job upon recommendation of his foreman. This control is not intended to be oppressive or used to create fear, but it is highly important for the men in a crew to believe that their foreman is the one who has the most to say about their progress and development. One simple way to do this is to let the foreman be the one to notify his men of any change in wages or position. How is it handled in your company? The odds are that the general supervisor or some one above the foreman handles all the wage increases directly with the men. With organized labor groups this is not much of a problem, because all wage changes are matters of negotiation and settlement by others than the foremen. It may well be, however, that the removal of this important item of control from the hands of the immediate supervisors of the men can be a contributing cause to the general lack of improvement in accident experience and poor job performance.

One of the above items deals with keeping unsafe men or inefficient workmen in a crew. It may sound drastic to give a foreman the privilege of making changes in his crew, but isn't that the way it should be? If he finds that a man is not teaming up properly with the rest

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Lightning Protection of Sub-Transmission Lines

By G. D. McCann

Transmission Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Penn.

Presented at Meeting of EEI Transmission and Distribution Committee Meeting, Buffalo, Oct. 9-10.

IN the past more consideration has been given to the protection of primary high voltage transmission lines than to the lower voltage lines in the 13.8 to 44 kv class. This is only natural since they have been considered to be the most vital link in the transmission system. For this reason and because more expense could be allotted to their construction, a much higher degree of lightning protection has been realized. However, in recent years the necessity of providing the most reliable service possible to war plants, in industrial areas fed by circuits in the subtransmission class, has made it important to give more thorough consideration to the protection of such lines.

The lightning protection of any transmission lines should be considered from three principal viewpoints:

1. Prevention of line outages.
2. Prevention of line damage.
3. Prevention of severe surges at substation, resulting in equipment damage.

In addition, subtransmission lines frequently carry lower voltage distribution circuits whose protection must be considered not only from lightning flashovers but also high sustained dynamic voltages from the transmission circuit.

Likewise, there are three general types of protection that may be used in various combinations depending upon the primary objectives and system conditions.

1. *Direct Line Protection*—The use of overhead ground wires or "Delon" protector tubes to eliminate line flashovers and high surge voltages. Some also believe that considerable reductions in flashovers and outages can be obtained by "over-insulation."

2. *Partial Line Protection at Substations*—The use of line protection for a short distance out from substations to reduce the severity of surges into the substation.

3. *The Use of High-Speed Reclosing or Ground Fault Neutralizers*—For the purpose of preventing loss of service from line flashovers.

It is the purpose here to consider some of the above phases of the lightning protection problem in the light of the more recent lightning current data obtained in the Westinghouse lightning investigation program. Consideration will be given principally to wood-pole lines.

Characteristics of Stroke Currents

When considering any phase of the lightning protection problem, one fundamental factor must be borne in mind. That is the highly variable nature of lightning in all of its characteristics. Different strokes may vary widely in their multiple character and duration and in the magnitude and wave shapes of the currents they discharge. Frequencies of storms and stroke densities vary widely in different localities even those falling in regions classified by the same isoceraunic storm levels. Furthermore, they will vary widely from year to year in any given locality. It is, therefore, necessary to consider the properties of lightning on a statistical basis and the performance of transmission lines must be based upon certain average lightning conditions. However, sufficient data are now available to afford a reliable comparison of various types of line construction.

An analysis of the distribution of surge currents for strokes to transmission lines,[1] indicates that the characteristics of the current in a given stroke are in general little affected by the impedance of the particular circuit struck. Thus, the stroke current is the most fundamental quantity from which the voltages impressed upon the transmission line, after contact by a stroke, can be calculated. An analysis of the multiple character, magnitude and wave shape of some 46 direct stroke currents are summarized in reference 2 and compared with data available from other investigations. After a stroke contacts the line, it is the high current-short duration portion of a component that produces the significant voltages. Statistical data on the frequency of occurrence of various crest magnitudes, fronts, and times to half value are given in Fig. 1 to 4. The number of stroke components and the duration of the low magnitude continuing currents that follow the high current peaks are of importance in determining arrester duty and other factors such as the probability of a lightning flashover causing sustained power follow, the minimum safe reclosing times and the fault clearing times for circuit breakers. Such data are discussed in detail in reference 2.

The curves of Fig. 1 to 4 provide a basis for calculating surge voltages from direct strokes. However, before discussing such data, it is important to consider several other factors.

Induced Surges from Indirect Strokes

Based upon our recent knowledge of stroke mechanism, an analysis has been made of the voltages that can be induced by indirect strokes.[3] This shows that voltages as high as 1000 kv can be induced on a line but that the number exceeding 500 or 600 kv is insignificant. Thus, from the standpoint of line performance alone induced voltages need only be considered for the lower voltage circuits with insulation levels below about 500 kv. However, an appreciable number of surges induced by indirect strokes reach substations with voltages in excess of the arrester breakdown values even for the higher voltage lines protected with overhead ground wires.[4] Probability curves for the voltages induced on low-voltage lines are given in Fig. 5. This shows, for instance, that a line with an insulation level of 300 kv might be expected to have about six flashovers per hundred miles of line per year from this source, while the use of an overhead ground wire would reduce the flashovers to about four.

Frequency of Direct Strokes to Transmission Lines

Crest ammeter measurements[5] of strokes to transmission lines in the 66 to 220 kv class have shown that the number of strokes per hundred miles of line per year in regions of isoceraunic levels ranging from 25 to 45 storm days per year will usually range between 50 and 200 with a general average of about 100. Less extensive data obtained in the

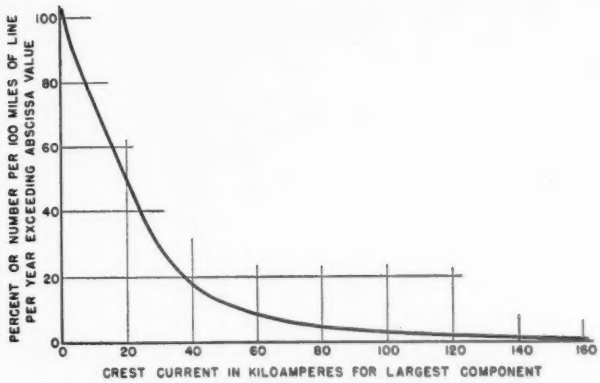

Fig. 1—Crest Magnitudes of Direct Stroke Currents (734 Strokes).

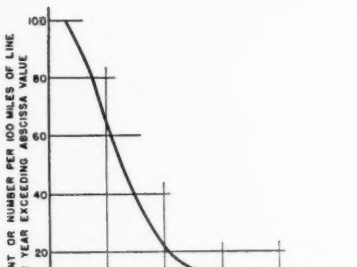

Fig. 2—Effective Fronts of Direct Stroke Currents (33 Values).

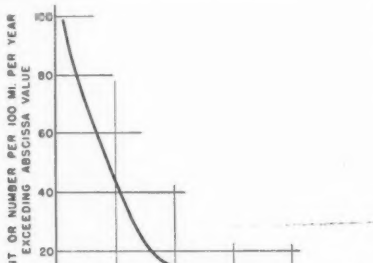

Fig. 3—Effective Rates of Rise in Direct Stroke Currents.

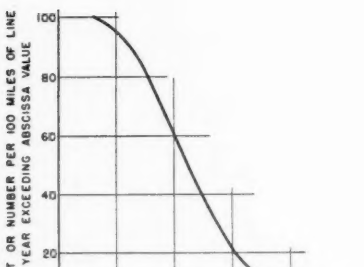

Fig. 4—Times to Half Value of Direct Stroke Currents (118 Values).

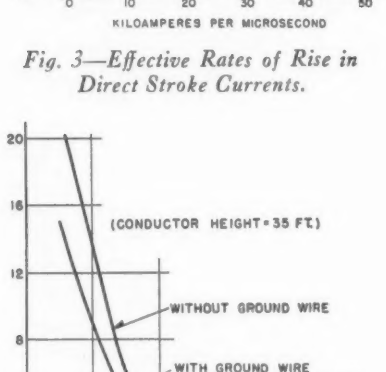

Fig. 5—Magnitude and Frequency of Voltages Induced by Indirect Strokes.

Westinghouse investigation shows the same order of frequency for 33-kv wood pole lines.

Characteristics of Line Flashovers

The variation of insulation level that usually exists along the lower voltage lines has an important bearing upon their flashover. A 33-kv line may have an insulation to ground of more than 2000 kv at tangent poles but at guyed poles this may be reduced to 500 or 600 kv.

As the initial streamers of a stroke propagate downward from the cloud, a relatively slow rate of voltage rise will start to occur on the transmission line conductors several hundred microseconds before actual stroke contact. During this period the voltage may easily reach 700 to 800 kv and being of slow rate of change will cause flashover at the lowest insulation point even though it be several miles from the point of stroke contact. After the stroke has actually reached the line, the high rates of current rise will produce correspondingly high rates of voltage rise and flashover may then also occur at or near the point of contact. Further, the initial breakdown of wood insulation is usually just inside the surface, resulting in very high arc drops that frequently permit the simultaneous flashover of a number of adjacent poles; sometimes 10 or 20. Strokes to such lines, therefore, usually set up several simultaneous discharges which is an unstable condition and if power follow is to occur it will be determined by the path with the lowest arc impedance which usually is the flashed guyed pole.

Ratio Between Line Flashovers and Outages

The insulation level of an unprotected line has only a slight influence on the percentages of strokes that cause flashover. Calculation of surge voltages from the curves of Fig. 1 to 4 show that for line insulation levels of 300 kv, about 90 per cent of all strokes will cause flashover, for 800 kv the figure is about 80 per cent and even for insulation levels as high as 3000 kv it is 50 per cent.

The probability of a flashover causing a sustained power follow depends upon a large number of factors including the type and length of the insulation path, the magnitude of the power follow current, the possible rate of system voltage recovery, and the magnitude and duration of the lightning flashover current. However, studies of rates of dielectric recovery[6] and performance records of lines both unprotected and with ground wires have yielded some data on the ratio between flashover and sustained power follow. For the higher voltage steel tower lines where the principal flashover path is in air, about 80 per cent of all lightning flashovers result in sustained power follow if the line length is less than 100 miles. The ratio is reduced to about 50 per cent for such lines over 200 miles in length because of the lower rates of system recovery voltage. Studies have also been made of the performance of several unprotected wood pole lines in the 22 to 44-kv class with all the phases on one 10-foot cross arm and having guyed poles with a flashover path to ground consisting of 10 to 15 feet of wood. These show that such a flashover path reduces the ratio of sustained power follow to flashovers considerably; the ratio ranging from 0.35

TABLE I—OUTAGES DUE TO LIGHTNING FOR LINES WITHOUT GROUND WIRES

Line	KV	Length of Line	Years Covered	Total Outages	Outages per 100 Miles per Line Year	Reference
Interstate Power Co. Clinton-Dubuque	66	54	.6	277	87	Wisco and Monteith, "Experience with Protector Tubes", Elec. Journal, August, 1938
Penna. Water & Power Holtwood-York	66	23	11	213	84	Hansson, "Design, Construction and Operation of a Lightning-Proof Transmission Line", KEI Publication No. P6.
16-A Type H Wood	110	79.4	6		24	Sporn, "Lightning Performance of 110 to 165 Kv Transmission Lines", Trans. AIEE, 1939, p. 294.
23-BB Type H Wood	132	39.8	8		37.2	
34-K Double Circuit	110	58.3	10		61	
Above 100 Kv - Steel		673	1929		21	Great Lakes Div. of NELA, 1929-30 Report of Overhead
		560	1930			
60 Kv to 100 Kv - Wood		594	1929		26.6	1930-31 Report of Engineering Section Trans. Line Operating Records 1930.
60 Kv to 100 Kv - Steel		481	1929		23.4	
		738	1930			
30 Kv to 60 Kv - Wood		3475	1929		34.6	
		420	1930		30.4	
Pennsylvania Power and Light Co. - Steel	220	41	8		25	Edgar Boll, "Lightning Investigation on a 220 Kv System, AIEE, 1934, p. 1184

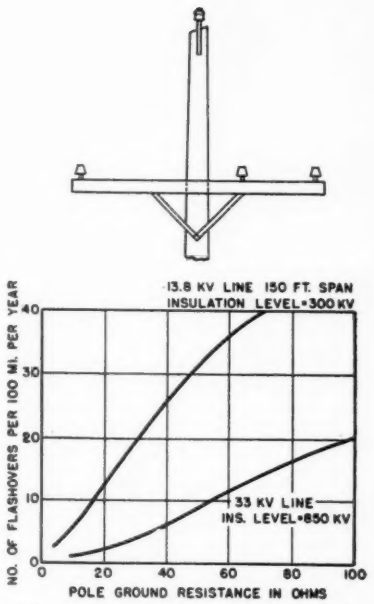

Fig. 6—Lightning Performance of 13.8 Kv Line with Ground Wires.

to 0.50. Thus, unprotected wood pole lines in this voltage class can be expected to have about 30 outages per 100 miles of line per year for the assumption of 100 strokes per year.

In table I are summarized outage data for several groups of unprotected lines located in regions of 25 to 45 storm days per year for which the figure of 100 direct strokes per 100 miles of line per year is applicable. These data confirm in general the above figures for the ratio between flashovers and outages.

Overhead Ground Wire Protection

In Figs. 6 and 7 are shown calculated flashover performance curves for several types of 13.8 kv and 33 kv construction that provide about the best ground wire construction economically feasible for most single circuit lines. These were determined from the fundamental stroke current data of Figs. 1 to 4. Curves of this sort show that the two most important factors determining flashover performance are the line insulation and the pole ground resistance. Of somewhat less importance is the distance between grounds. These curves assume perfect shielding. For lines this voltage class, shielding angles as great as 45 deg. are sometimes justified, but 30 deg. is preferable.[7]

It would usually not be considered feasible to provide more than one cross-arm for the 13.8 kv class of lines. Even when 10-foot cross-arms are used, this limits the insulation between the phase conductors and pole downleads to about 300 kv. This is only obtained when the downlead is either supported on the cross-arm midway between the two phases farthest apart or separated at least one foot from the pole. By the latter method the minimum flashover path can be made in air, thus protecting the wood insulation from splintering.

In Fig. 7 comparison is given between the flashover performance with the pole downleads laid along the pole and separated from the pole in such a way as to provide the maximum insulation level and provide protection for the wood insulation. Greater improvement is obtained for the construction on the left of Fig. 7 by separating the pole downleads since it provides a greater increase in insulation. It is of interest that no improvement of these lines would be ob-

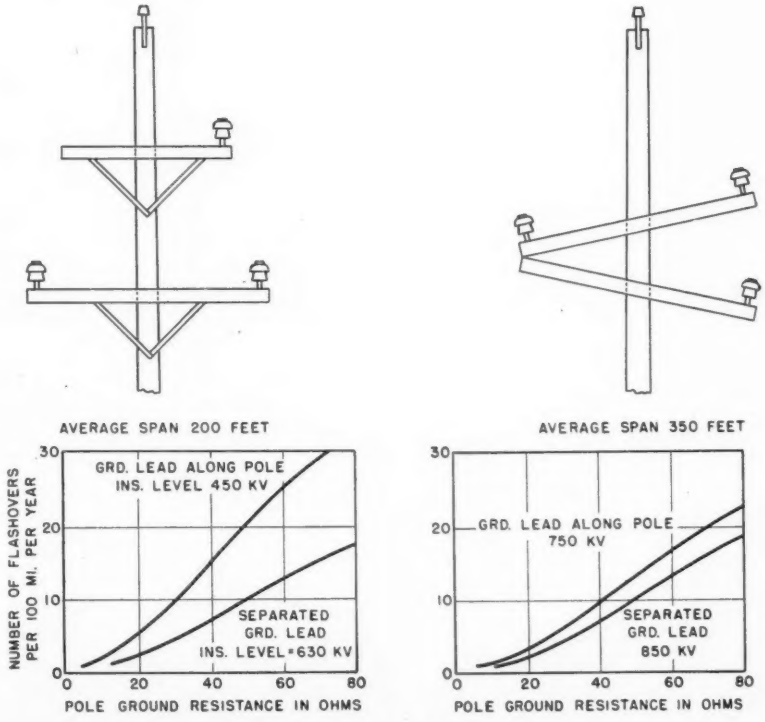

Fig. 7—Lightning Performance of 33 Kv Wood Pole Lines with Ground Wires.

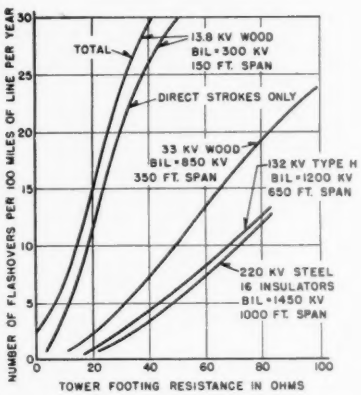

Fig. 8—Comparative Lightning Performance of Transmission Lines Equipped with Overhead Ground Wires.

shows that the use of ground wires for the 13.8-kv class (or any class with an insulation level as low as 300 kv) is not justified unless ground resistances below 10 ohms are easily obtainable. For this class ground wires will seldom compete with "De-ion" protector tubes. However, when insulation levels of 600 to 800-kv can be obtained (which is feasible for 33 kv and above), good performance can be obtained with overhead ground wires for ground resistances as high as 30 to 40 ohms.

Line Protection with "De-ion" Protector Tubes

Frequently, a very effective and economical type of construction can be obtained by placing one phase high enough above the other two for adequate shielding and then equipping it with "De-ion" protector tubes. When tubes are installed at intervals of 400 feet or less, such construction will give performance comparable to that shown in Figs. 6 and 7. As shown by these figures such construction will give very good performance where insulation levels of 500 to 600 kv can be obtained and the ground resistance does not exceed 20 or 30 ohms. This has been borne out by experience.

Where adequate shielding of the other phases cannot be obtained by applying protector tubes to one phase only or when low grounding resistance cannot be obtained, three-phase tube installations are to be preferred. In the past it has usually been the practice to recommend tubes at every pole so that flashovers at unprotected poles would not be permitted. However, the economic advantages of reducing the number of protector tubes has made it desirable to study the relative performance of tubes applied at varying spacings. Data on this for three-phase tube installations are given in Figs. 9 and 10. These curves were determined from the stroke current data of Figs. 1 to 4. Pole ground resistances have little effect for the spacings given in Figs. 9 and 10 until it exceeds about 50 ohms. The insulation levels shown apply to the phase-to-phase insulation at unprotected poles.

As shown by comparison of the curves for the two assumed span lengths given in Fig. 10, performance (at a given insulation level) is determined principally by the distance between tube installations and not greatly affected by the number of intervening unprotected spans. The curves of Fig. 9 were calculated for a type of construction with actual performance records for tubes installed at three different spacings showing good comparison between calculations and actual performance. One fact of importance shown by these figures is that practically the same performance is to be expected for tubes spaced a given number of odd spans as for the next smaller number of even spans. Thus, spacings at odd spans are to be preferred.

In determining the performance of single phase tube installations there are two types of flashover to consider. One of these are flashovers at points between tube installations which are little affected by tube grounding resistance as long as it is below 30 or 40 ohms. The other is flashover from the protected phase to an unprotected phase at a protected pole due to the drop across the tube ground resistance.

An analysis has not yet been made of the overall performance to be expected of single protector tube installations as a function of tube spacing. However,

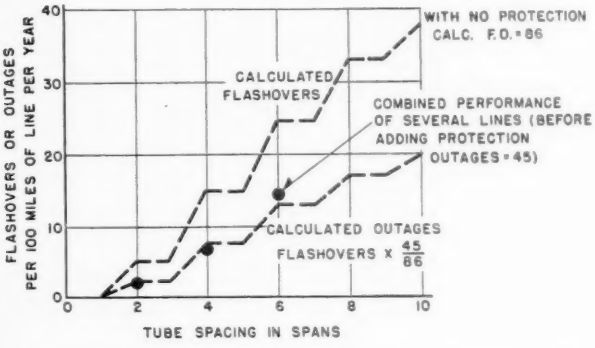
WITH NO PROTECTION
CALC. F.O. = 86
CALCULATED FLASHOVERS
COMBINED PERFORMANCE OF SEVERAL LINES (BEFORE ADDING PROTECTION
OUTAGES = 45)
CALCULATED OUTAGES
FLASHOVERS x 45/86
FLASHOVERS OR OUTAGES PER 100 MILES OF LINE PER YEAR
TUBE SPACING IN SPANS

Fig. 9—Effect of Three Phase "De-ion" Protector Tube Spacing on Wood Pole Lines of 13.8 Kv Class 150 Ft. Spans. B.I.L. = 600 Kv.

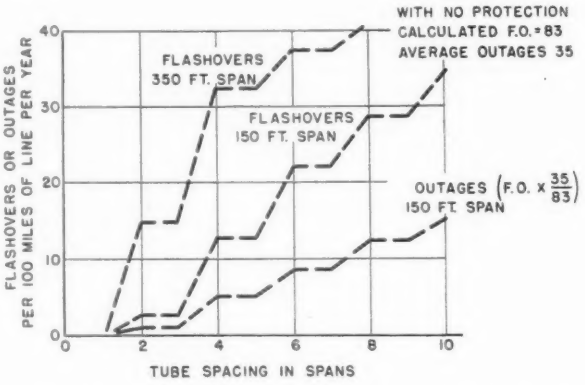
WITH NO PROTECTION
CALCULATED F.O. = 83
AVERAGE OUTAGES 35
FLASHOVERS 350 FT. SPAN
FLASHOVERS 150 FT. SPAN
OUTAGES (F.O. x 35/83) 150 FT SPAN
FLASHOVERS OR OUTAGES PER 100 MILES OF LINE PER YEAR
TUBE SPACING IN SPANS

Fig. 10—Effect of Three-Phase Protector Tube Spacing on 33 Kv Wood Pole Lines. B.I.L. = 750 Kv.

tained with suspension insulators when the separated ground lead is used since the minimum flashover path in the air is determined by the cross-arm length. In fact swinging of the insulator strings would tend to reduce the effective insulation. The construction on the left of Fig. 7 with a lower minimum insulation level gives comparable performance to that on the right because the phase on the top cross-arm (which determines the minimum insulation) is closer to the ground wire thus providing greater coupling.

For such wood pole lines, having a flashover path in air alone, a figure of 0.6 to 0.8 for the ratio between outages and flashovers should be used instead of 0.35 to 0.5 ratio which is applicable to flashover paths of wood.

Fig. 8 compares the flashover performance obtainable with overhead ground wires in the 13.8, 33, and 132-kv classes of wood construction and with 222-kv steel tower lines. This figure

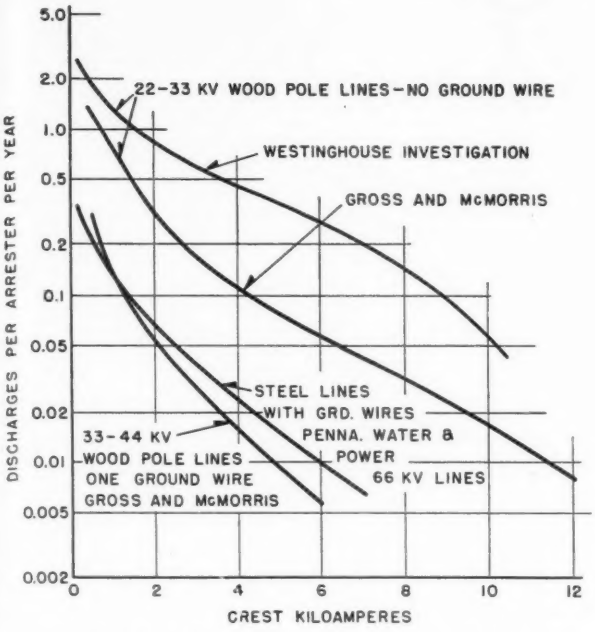

Fig. 11—Probability of Crest Currents in Station Arresters.

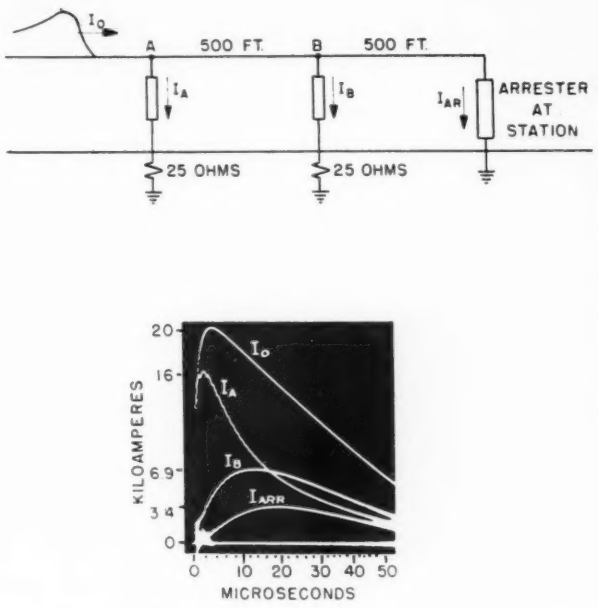

Fig. 12—Reduction of Station Arrester Duty by Multiple Sets of Protector Tubes.

unless the ground resistances are kept below 5 to 10 ohms, it can be said that the number of flashovers will considerably exceed such values as given by Figs. 9 and 10 for spacings in excess of 900 to 1000 feet.

Effect of Line Protection on Severity of Surges at Substations

Fig. 11 shows the relative severity of surges appearing at substations connected to protected and unprotected lines. The curves apply to the number of surges appearing at a three-phase arrester bank at the end of one line. As shown line protection can be expected to reduce the total number of surges from about two per year to about 0.3 per year. Likewise, the relative frequency of a given magnitude surge is reduced in about the same ratio (roughly 10 to 1).

Effectiveness of Sets of Protector Tubes at Substation End of Unprotected Lines

A study has been made of the reduction of the station surge current and voltage obtainable with various combinations of "De-ion" protector tubes located a short distance out on the line. This study was made with model transmission line circuits that have been developed to facilitate studies of the propagation of traveling waves. Such circuits are now available for representing a comprehensive range of system conditions including both cable and overhead circuits and various types of terminal equipment.

Fig. 12 shows typical oscillograms of the surge currents determined in this manner. Fig. 13 gives a comparison of the effectiveness of various tube combinations. A combination of tubes that reduces by 10 to 1 the magnitude of the surge current reaching the station arrester provides about as good station protection as a completely protected line. As shown by Fig. 13 this can be accomplished with one set of tubes 500 feet out on the line if a tube ground resistance of 5 ohms is obtainable. With a ground resistance of 10 ohms it can be accomplished with one set of tubes 1000 feet out. However, for grounding resistance of 25 ohms, three sets of tubes at 500 foot intervals are required.

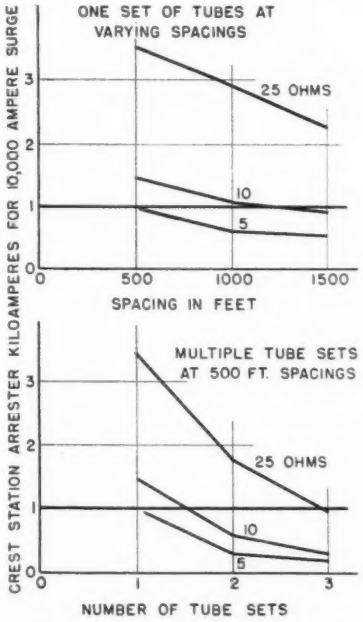

Fig. 13—Effect of Protector Tube Spacing, Ground Resistance and Number of Sets upon Reduction of Station Arrester Duty.

Distribution Circuits on Transmission Line Poles

Another important consideration is the protection of distribution arresters for circuits mounted on transmission line poles. Probably more distribution arrester failures than realized occur from sustained dynamic overvoltage from such higher voltage lines. Lightning flashovers are likely to start a power follow arc from the high voltage circuit and through one or more distribution arresters to ground. The stability of such an arc is again a question of the relation between the transmission system recovery voltage and the insulation dielectric recovery characteristics. Considerable trouble of this type occurs when only a few feet of wood or air insulation separates the two circuits. Relatively little trouble appears to be experienced (with

(*Continued on Page* 358)

The Watthour Meter — Modern Versus Old

By Arthur B. Craig
Boston Edison Company

IN late 1940, a survey on a national scale was started to determine the comparison of registration of modern and older types of meters. Two methods were proposed; the first involved the installation of a modern meter in series with the existing meter for the obtainment of comparative data, the second involved the installation of recording meters to obtain all pertinent facts on load characteristics. Of the two methods, the Modern-meter-Comparison method appeared to be more practical for the purposes of this investigation and was therefore adopted.

A suggested procedure and data sheets were prepared and sent to a number of electric utilities. Briefly the suggested procedure called for the series installation of a modern 15-ampere meter with an existing 5-ampere meter of the type manufactured between 1914 and 1926 whose normal monthly usage exceeded 75 kwhr, both meters to be read monthly for a period of six months. Modern and older type meters were all to be calibrated at the beginning of the test so as to be within an accuracy range of 99.8 per cent and 100.0 per cent at both full and light load calibration points. The installation of 15 minute demand meters was also recommended. The investigation was limited to the 5-ampere size of older type meter and to domestic loads with the understanding that future investigations might be made on larger meters and on commercial loads. Individual monthly readings which did not cover a 28-32 day period were prorated on a 30 day basis, and cases showing a usage of less than 10 kwhr were excluded.

Before this investigation reached the actual field test stage, December 7, 1941, arrived! Thereafter, for obvious reasons, many companies found it impossible to make any tests and others had to limit the number of installations. However eight companies did participate, six of them obtained comparative readings for a period of six months, the other two extended their investigation over a 12-month period. There was a total of 442 installations with 3580 comparative monthly readings. Particularly noteworthy is the fact that approximately

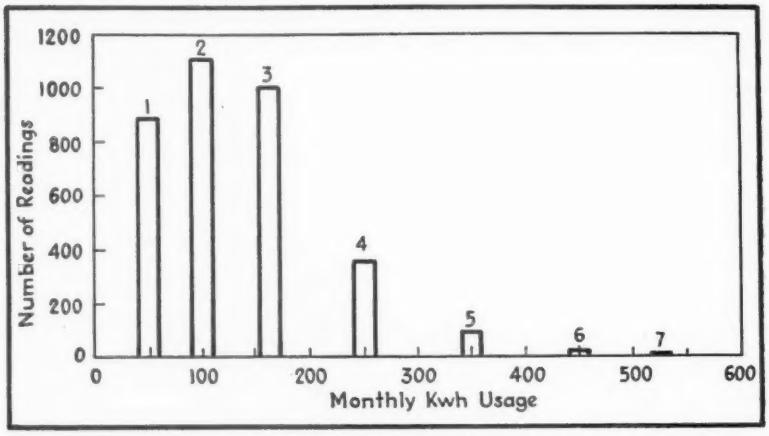

Fig. 1—Number of readings in various monthly kilowatt hour usage ranges kwhr per month: (1) 10-75; (2) 86-125; (3) 126-200; (4) 201-300; (5) 301-400; (6) 401-500; (7) over 500.

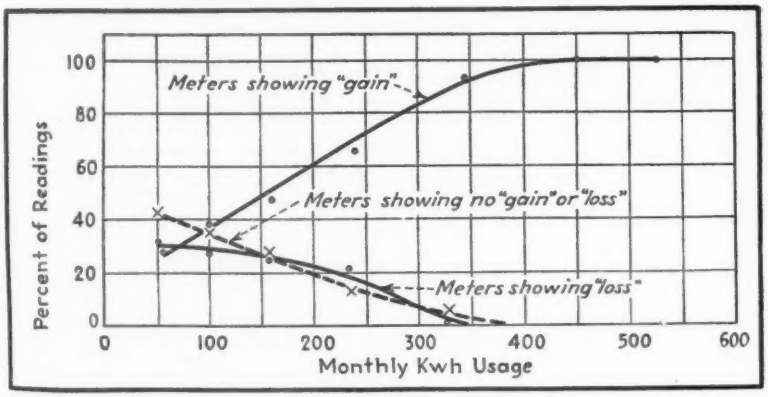

Fig. 2—Per cent of readings which show "gain," "loss" and no "gain" or "loss." "Gain" is excess registration of modern meter over older type meter. "Loss" is excess registration of older type meter over modern meter.

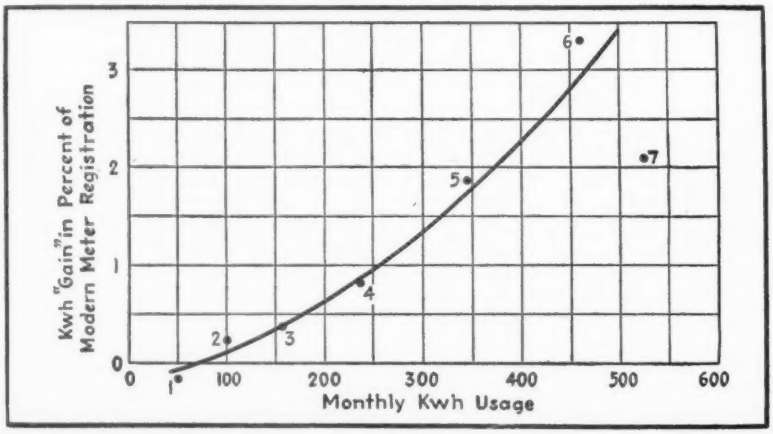

Fig. 3—Average kwhr "gain" for various monthly kwhr usages. Points represent same brackets of consumption as in Fig. 1.

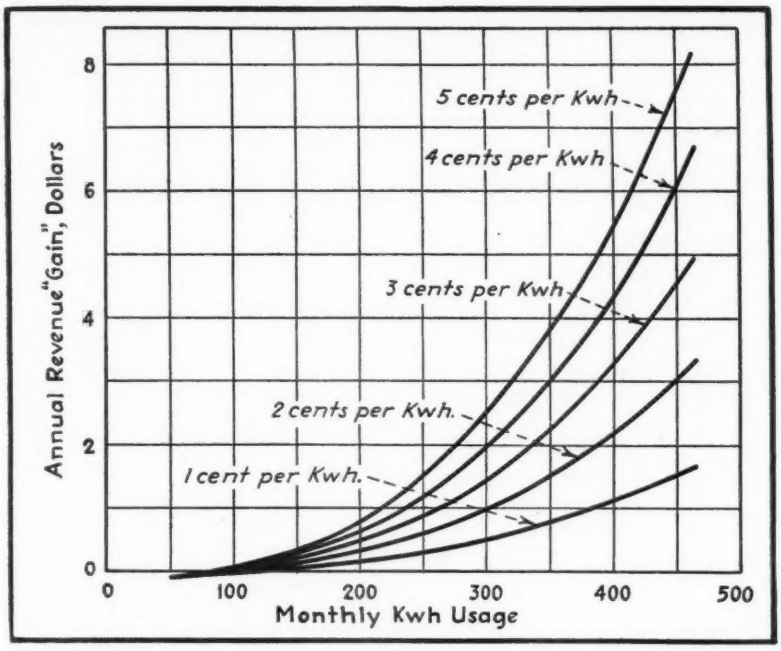

Fig. 4—Approximate annual revenue "gain" from modern meter for various monthly kwhr usages.

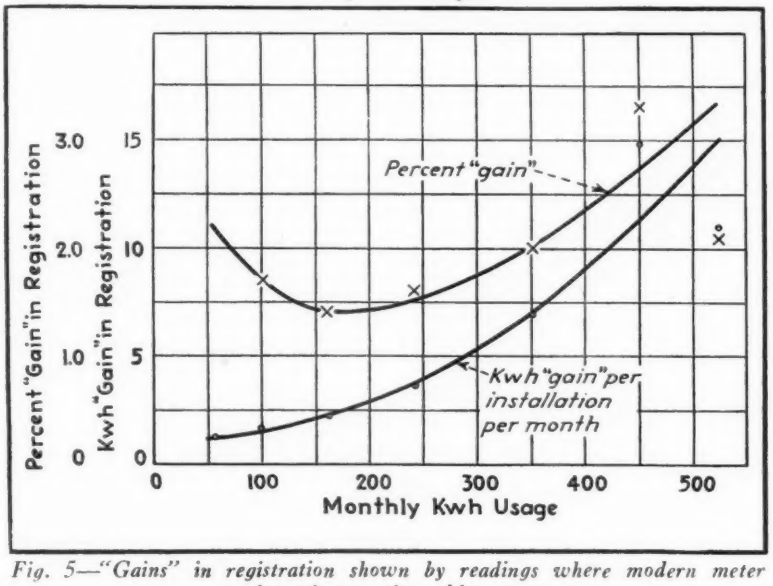

Fig. 5—"Gains" in registration shown by readings where modern meter registered more than older meter.

Watthour Meter Comparison

	Total	Co. 1	Co. 2	Co. 3	Co. 4	Co. 5	Co. 6	Co. 7	Co. 8
Number of Installations	442	53	50	56	50	48	11	102	72
Duration of Test (Months)	8.1	12	6	6	6	6	6	12	6
Total Registration of Modern Meter (khw.)	439469	69630	45079	55278	60843	42849	7953	92480	65357
Total Registration of Older-Type Meter (kwh.)	437120	69497	44820	54872	60439	42496	7887	92123	64986
Modern Meter Gain (kwh.)	2349	133	259	406	404	353	66	357	371
Modern Meter Gain in percent	0.5	0.2	0.6	0.7	0.7	0.8	0.8	0.4	0.6
Gains in Registration:									
(a) Number of Installations	253	24	35	30	18	37	8	59	42
(b) Total kwh. gain	3450	344	346	500	565	384	90	583	638
Gain/Installation/Month (kwh.)	1.6	1.2	1.6	2.8	5.2	1.7	1.9	0.8	2.5
Losses in Registration:									
(a) Number of Installations	161	25	10	19	29	10	3	36	29
(b) Total kwh. Loss	1111	211	87	94	161	31	34	226	267
Loss/Installation/Month (kwh.)	0.8	0.7	1.4	0.8	0.9	0.5	1.9	0.5	1.5
Installations showing no gain or loss	28	4	5	7	3	1	0	7	1

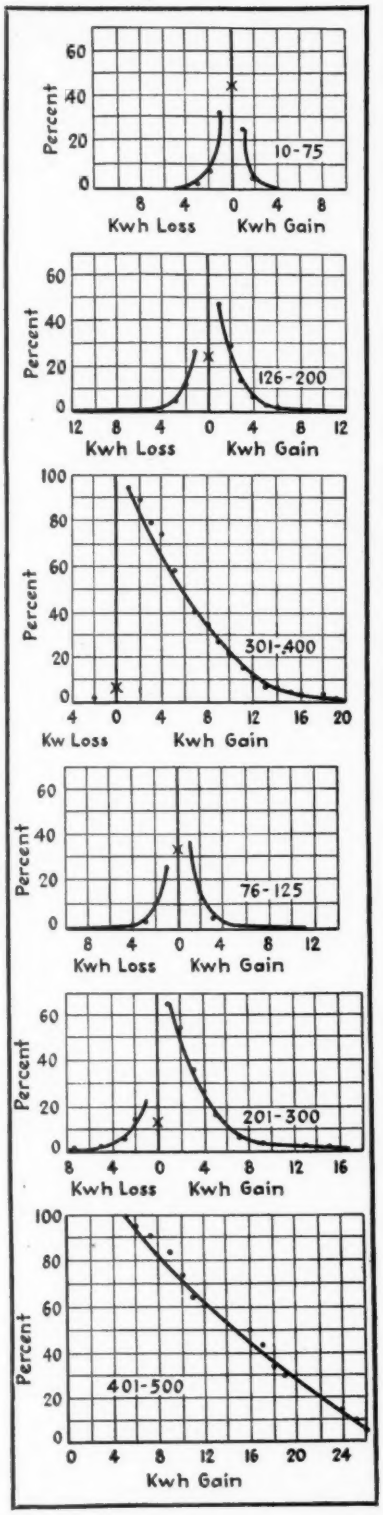

Fig. 6—Per cent of readings in each range group showing monthly kwhr differences at least as great as indicated by the abscissae. Figures on each indicate monthly kwhr usage.

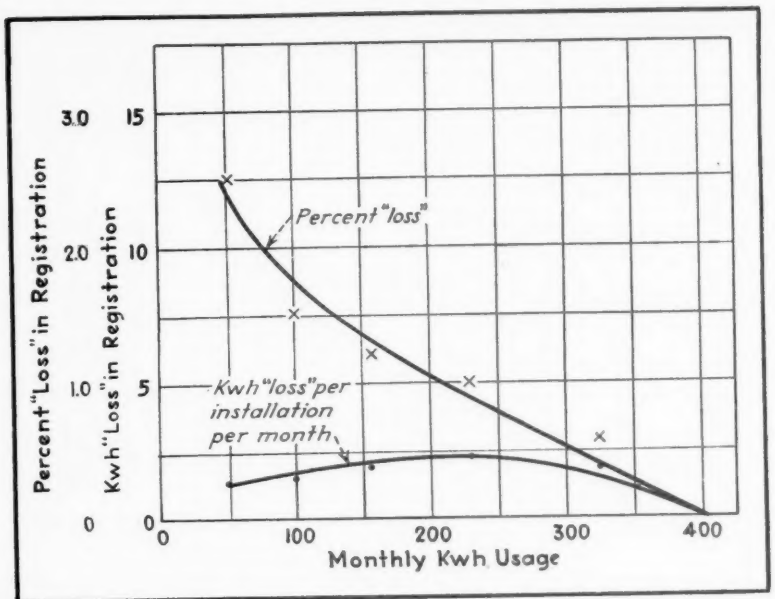

Fig. 7—"Losses" in registration shown by readings where modern meter registered less than older meter.

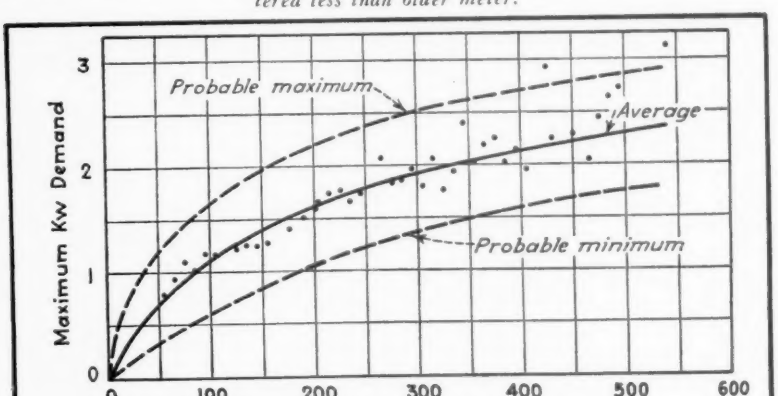

Fig. 8—Relation between maximum kw demand and monthly kwhr usage

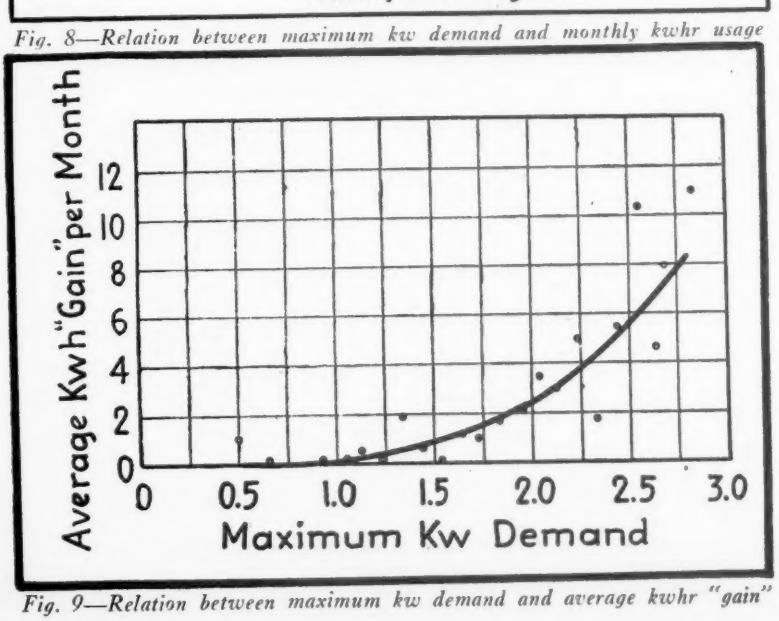

Fig. 9—Relation between maximum kw demand and average kwhr "gain"

25 per cent of the installation and 35 per cent of the readings came from the Pacific Coast.

One company reported that in a survey of two meter reading routes having a total of 517 customers, the customers with 115-volt 2-wire meters and with a usage in excess of 75 kwhr were distributed as follows:

Size of Meter	*Customers Using* 75-125 Kwhr	125-200 Kwhr	Over 200 Kwhr
5-1-2	61	39	10
10-1-2	37	17	10
15-1-2	11	6	0
	109	62	20

The 442 installations investigated naturally are only a very small fraction of the total number of older type 5-ampere meters in domestic service, but they are representative of this type of installation and these results should give a reasonable indication of the conditions that may be expected in service.

It is believed that the table and curves are self explanatory and are therefore offered without comment. Individual situations should be carefully analyzed before attempting to apply this data.

Definition of "gain" and "loss":

"Gain"—Excess registration of modern meter over older type meter.

"Loss"—Excess registration of older type meter over modern meter.

Lightning Protection of Sub-Transmission Lines

(*Continued from Page* 355)

33 kv and below) where 8 to 10 feet of wood insulation separates the two circuits. For localized cases where considerable trouble is being experienced from this source, special applications of protector tubes between the two circuits are feasible.

[1] Discussion by C. F. Wagner and G. D. McCann of paper by S. K. Waldorf, AIEE Trans., Vol. 60, 1941, p. 702.

[2] The Measurement of Lightning Currents in Direct Strokes, by G. D. McCann, AIEE Tech. Paper No. 44-114, May, 1944.

[3] Induced Voltages on Transmission Lines, by C. F. Wagner and G. D. McCann, AIEE Trans., Vol. 61, 1942, p. 916.

[4] Discussion by G. D. McCann of paper by S. K. Waldorf, AIEE Trans. Supplement, June, 1944.

[5] Experience with Preventive Lightning Protection on Transmission Lines, by S. K. Waldorf, AIEE Trans., Vol. 60, 1941, p. 249.

[6] Dielectric Recovery Characteristics of Large Air Gaps, by G. D. McCann and I. J. Clark, Electrical Engineering, January, 1943, Vol. 62, p. 45.

[7] Shielding of Transmission Lines, by C. F. Wagner, G. D. McCann, and G. L. MacLane, Jr., AIEE Trans., Vol. 60, 1941, p. 313.

Improvement of Service Reliability Through Intelligent Use of Records

By T. H. Haines
Boston Edison Company

Presented at Meeting of Transmission & Distribution Committee, E.E.I., Buffalo, N. Y., Oct. 9.

BEFORE 1929, Boston Edison Company made statistical studies of system operation on an intermittent and unrelated basis. Between 1929 and 1933 increasing attention to the subject resulted in the System Trouble Analysis, which was a complete study of the cause and effect of each trouble occurring on the Transmission and Distribution System. Shortly thereafter the Boston Edison Company joined with four other companies in an attempt to place such studies on a comparative basis. Between 1934 and 1937 these studies were exchanged among the participants, but it was found that basic differences in the nature of the territories served made it difficult to make comparisons of value. In 1937 the exchange of studies ended, but each company continued on a basis suited to its own interests.

While the above history indicates the difficulty of comparing system performance between utilities, the use of such records still will be found highly useful for improving distribution system operation. From the study of the system operation of the Boston Edison Company it was found that the overhead and underground 4 kv systems were the source of over 95 per cent of the outage to the average customer, due to the large number of customers whose services are interrupted by trouble on a 4 kv circuit. During the past decade or so, increased attention has been given to the performance of various elements of design of the 4 kv system as determined by the statistical studies. Data on the cause and effect of each trouble being available in sufficient detail made it possible to estimate the improvement and cost or saving which would result from each proposed improvement.

Figure 1 is a ten-year record of trouble originating on the 4 kv overhead distribution system. Total troubles are shown and also those troubles which caused outage. Both types of troubles represent a cost to repair but the outage troubles are far more important since they cause service interruptions. A curve of outage has also been included, using arbitrary outage units for convenient comparison.

Examples of the improvements which study of the records indicated and which resulted in the halving of trouble and outage during the ten-year period shown are the following:

1. The shunt connecting of lightning arrestors.
2. Discontinuance of tree insulators in favor of tree wire and waxed tree molding.
3. Double spacing of line wires.
4. Modernization during repair of transformers.
5. The elimination of dry process pin and strain insulators.
6. The adoption of the common neutral with the resulting removal of line wire, fuse cutouts, lightning arrestors, and one pole of oil switches.
7. The use of improved line wire.
8. The adoption of ground return series lighting which reduces wire congestion on cross arms.
9. Intensive tree trimming.

Figure 2 is a corresponding ten-year record of the 4kv underground system. On this system it will be noted that there are relatively few troubles and the scale has been increased accordingly. However, underground troubles usually result in extensive outage and this increased scale would have carried outage off the page if plotted on the same basis as Figure. 1. It has, therefore, been

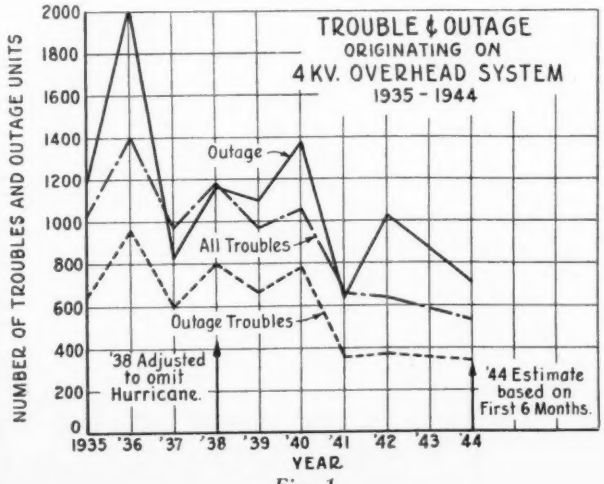

Fig. 1

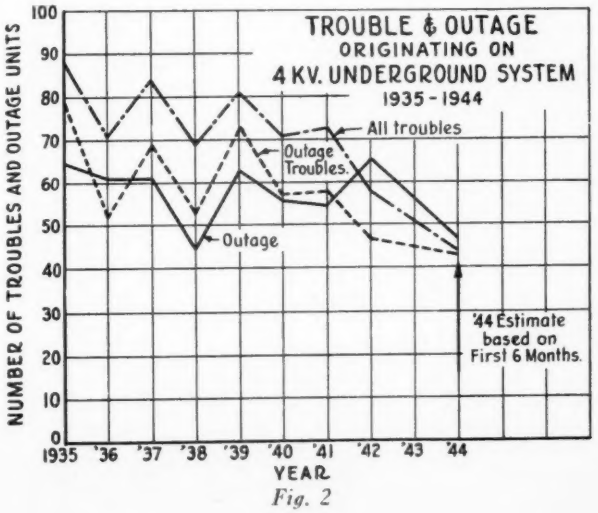

Fig. 2

plotted at one-tenth of the comparative values.

Contributing to the improvement in underground 4 kv system operation have been the following:

1. Improved design of oil switches and modernization of older switches during repair.
2. Improvements in gasket materials.
3. Elimination of 4 kv potheads.
4. Lowering of transformer terminal boards to below oil level.
5. Elimination of transformer primary terminal boards where feasible.
6. Improved joint designs.

In the case of the underground system, grounded system operation has of course tended to increase the outage per trouble with the result that the outage curve shows a lesser drop.

In 1942 a total of 21 trucks were equipped with two-way short wave radios. Data since that time is too meager for statistical proof, but it has already become obvious, particularly during the recent hurricane, that this equipment is of tremendous aid in reducing restoration time. It is therefore expected that with future improvements in distribution plant yet to be made and with the cumulative effect as past improvements are incorporated during maintenance, that troubles and outage will continue to fall to new low values.

By What Steps?

(*Continued from Page* 350)

of his crew, why shouldn't he be able to recommend a change? Maybe the foreman's superior can point out ways to correct the trouble without such a move, but he should persuade the foreman to accept the man rather than force him to keep some one with whom he cannot produce a job required. How is it handled in your company? Are you always as careful to give your foreman as good and compatible human tools to work with as you do the inanimate tools of his job? Certainly he should have a majority vote when it comes to deciding on the keeping in his particular crew a man with whom he cannot give a good job performance.

These five items constitute a basis of company policy for giving the foreman the authority that goes with the responsibility he is generally expected to carry. You may well ask, "What do the last four of these items have to do with safety?" My answer is to remind you of the original premises:—that safety means good working habits which are obtained through job training, and this training must be administered by the foreman. In order for him to do a good job of this he must be given as much authority and prestige as possible. All of the five items above are just some ways in which this can be accomplished. The foreman must be made to feel that he is responsible for accident prevention in his crews, and that safety is just one part of a good job. An accident means that he has failed to turn in a 100 per cent performance. If the foreman does not feel this responsibility, it is almost a certainty that his safety record will suffer. No one can carry this burden but the foreman, and the best the safety director and the top layers of supervision can do is to give him all the training, support and help possible.

My comments here are intended primarily to have you scrutinize your own company to see if you are enhancing your foreman's position with his crew, and giving him the training and authority commensurate with the job you are expecting him to turn out. If you are not doing this, you are blocking your own way to better and safer job performance.

Ousler Expands Organization of E.E.I. Commercial Committees

EXTENSIVE reorganization and expansion of the Commercial Committees of the Institute, with the objective of best meeting present and postwar conditions in the sales field of the industry, are nearing completion under

the direction of George W. Ousler, newly appointed Chairman of the EEI Commercial Division General Committee. In next month's issue of the BULLETIN Mr. Ousler will discuss in detail the reorganization of the Commercial Division and its program.

Mr. Ousler is Vice-President in Charge of Sales, Duquesne Light Company, and also a Vice-President of the Allegheny County Steam Heating Company. Born in Boston, Massachusetts, Mr. Ousler was graduated from the Massachusetts Institute of Technology in 1916, and entered the employ of the Duquesne Light Company on July 1 of that same year, in the Engineering Department. Since that time he has held various positions in the Company.

In 1923 he was in active charge of engineering negotiations with large customers, and in 1926 he was transferred to the Commercial Department as Manager of a newly-formed Engineering Division, in charge of estimating cost and preparing designs for substations and line extensions for customers' installations. In August, 1927, he was made Director of Sales Engineering, continuing his former engineering duties, and, in addition, assuming charge of the Municipal Section in the newly-formed General Sales Department.

In May, 1928, at the formation of the Sales and Service Department, he was made Manager of Sales Development and the Rate Department of the Gas, Electric, and Steam Companies was placed under his charge in addition to his present duties. In April, 1929, he was made Manager of Rates and Retail Service in Charge of Central and District Gas and Electric Retail Sales and Service, Home Service, and Rates, of the Philadelphia Company.

On April 1, 1931, Mr. Ousler was made General Sales Manager in charge of all general sales activities of the Duquesne Light, Equitable Gas, and Allegheny County Steam Heating Companies, which position he held until his election to the vice-presidency.

The Weatherman Can Help in Load Forecasting for Utilities

By A. E. Davison
The Hydro-Electric Power Commission of Ontario

Excerpts from a Paper Presented at a Meeting of Transmission and Distribution Committee, E.E.I., Buffalo, N. Y., Oct. 9.

LOAD forecasting takes up much of the time of operating men and engineers in many types of service —transportation, including the marine and air services, e.ectric power utilities, communication requirements, parking facilities, textile mills and, above all, the primary producers of food and clothing and those farmers who have learned that "there is a time to sow and a time to reap."

Operating engineers and load despatchers for the electric utilities are becoming more and more conscious of the importance of load forecasting. This is especially true at times when no kilowatthour, within the watersheds on which hydro-electric generating plants under the control of the load forecasters are located, should be wasted but must be conserved for use at one time or another during later seasons. This is particularly true now when engineers and the public generally are discovering that there is a recognizable limit to the recoverable amount of stored energy in the coal, gas and oil which can be won from the earth. Engineers know that wartime fuels should not be consumed by banked fires under standby boilers, nevertheless they must know, by authoritative load forecasts, that these boilers are ready for use if the weather should become on short notice unfavorable either by overcast clouds, thereby increasing the demands on a system, or by interfering with the transmission interconnections between the various generating stations and the loads to be served. For instance, one electric generating station may be called upon suddenly to provide a considerable overload of one, two or three hours' duration. Overloads of this kind can be carried by both hydraulic and steam stations if the load despatcher is forewarned in time by the weatherman.

Precipitation, Run-Off and Ground Water Storage

Other long-range load forecasters need as much assistance as can be secured in estimating during one season what the rainfall will be for the following season or seasons. They may find it necessary to forecast, one or more years in advance, the water-storage, rainfall and the output of generating stations at peak loads for each watershed in which they are interested. They may not expect important assistance from the weatherman so far in advance, but meteorologists should know more about rainfall possibilities in an area than can be expected of electric load forecasters. Both organizations install gaging stations, the records of which should be regularly exchanged.

Current Literature

A number of articles have appeared recently in the technical press on the general subject of weather forecasting and the need of electric load forecasters. Commerce Magazine, published by the Chicago Association of Commerce, in its February and May (1944) issues, discusses weather predicting as a new and enlarged service in postwar business. They point out such facts and opinions as the following:

As a result of the war, meteorology has taken its place as a major science, prominently linked with the expansion of aviation.

Remarkable advances have been made not only in weather forecasting methods and techniques, but in instruments and equipment; practically all of them are now classed as military secrets for the duration.

There are in the Armed Forces alone many more trained meteorologists than were active in the Weather Bureau prior to 1940.

Numerous plans are under way to provide postwar employment for the experienced and expert weather forecasters whose activities are now exclusively military.

There is every indication that the number of private meteorological services for business, agriculture and industry will be expanded rapidly as soon as demobilization begins. In fact, it is becoming a very competitive field.

Unofficially, it is reported that the United States Weather Bureau is laying concrete plans for an expansion and "personalizing" of its service to business and industry.

Business and industry recognize more than ever the importance and extreme value of accurate and dependable weather forecasting organized to provide specific information for specific lines of activity.

These writers also indicate that the weatherman can be depended upon, mentioning specifically the accomplishments of Dr. Irving T. Krick, former Director of the Department of Meteorology of the California Institute of Technology, who is for the duration with the U. S. Military Forces abroad. In the May, 1944 issue, Mr. Arnold White points out that financial losses (some specific cases are mentioned) can be reduced or eliminated if attention is given to the forecasts of the weatherman. The weatherman should have at hand information which the various utilities and services have, from experience, found essential and, as well, those weather records which are part of their normal recordings. He should know exactly what information utilities need. This, Mr. White states, can be learned by calling upon men at their work and by seeing personally at the office or at the electric substation just what is needed.

Meteorologists must be informed of the needs of power companies before attempting special forecasts for them.

Some of these needs are:

Maximum possible advance information and notice, together with cancellations of forecasts if and when meteorologists recognize unanticipated changes in their predictions.

Thunderstorms: time of commencement and ending, intensity and direction.

Some statement of storms to date for the year is desirable.

Winds of 25 m.p.h. or more, and their direction.

Relative daytime illumination, cloud overcast and fogs, both seasonal and incidental, and apart from whether they are for long or short duration.

Precipitation, with accumulated amounts for the year and for the particular storm, involving both forecasts and records.

Incidence of freezing rain in the territories traversed by transmission lines, with as much advance notice as possible.

Thickness of glaze formations on wires and like objects during the progress of each storm and collectively for the season, involving, as in precipitation, both forecasts and records.

Snow or rain, giving approximate times of beginning and ending, and, during the course of the longer storm, give the cumulative snow depth and precipitation equivalent. When forecasting snow and when recording amount of snowfall as precipitation, say whether snow will be dry, powdery, of average consistency or heavy and water-laden, that is, air temperatures during and after snowfall.

Relative radio interference.

Humidity relatively and, of course, more particularly anticipated major changes in humidity.

Probable date of freeze-over and of break-up of rivers in various watersheds, these forecasts to commence as far in advance as feasible and to be cancelled and revised from time to time.

Reducing the Number and Duration of Faults in Electric Power Systems

A desirable routine to be set up in advance by the despatchers of an electric power system, once thunderstorms or, more particularly, glaze storms are predicted is:

Everyone connected with the system should be on the alert and immediately available, apart from whether they are on duty at that time or not.

Return all equipment (including controls, protective apparatus and, as well, reserves and alternates) which is at all fit for use and which is under repair or otherwise not available as a reserve, into service with temporary connections. Do this where at all possible—even for a noon-hour period and especially over a weekend—thereby avoiding unnecessary loss of service to important customers and, in other cases, unnecessary exposure of unprotected and uncontrolled equipment.

Re-route commercial loads as promptly as possible to that temporary system and intersystem set-up which has been planned and which, from experience, offers in the opinion of the load supervisor the best defense against the type of storm predicted.

Recall or temporarily assign vacationing and off-duty employees and like absentees to key positions or to strategically located reserve pools.

Know that men in the immediate vicinity are available to operate on very short notice, remotely located sectionalizing switches.

Notify important and interested customers to stand by for load adjustments without interruption of service and for the possibility of accidental interruptions.

Stand by for forecast cancellations and revisions and for the all-clear weather notice before restoring normal economic system operating set-ups.

Financial Savings

If the advice of weather forecasters to agriculturists, industrialists, transportation interests and utilities is closely followed, then all losses due to weather conditions and the life hazards of airborne and sea-borne traffic can be greatly reduced. It is reported that one manufacturing company saved approximately $10,000 annually by making use of predicted minimum temperatures. In the future, data may be available for authoritatively establishing savings within electrical utilities, since the cost of restoration of lines and works of electric power, communication and transportation interests, after a severe glaze storm over large areas, in the past has run collectively into seven figures.

For instance, in a discussion of the important economic results, because of foreknowledge of storm paths, it was estimated that the repair of damage to an idle link of an important high-voltage transmission loop might amount to $50,000, and that the potential loss of revenue resulting from the fault might be as much as $15,000 per day.

Future Developments

If a student wishes to review the development of meteorology, an excellent history of that science on this continent appears in the current numbers of the Journal of the Franklin Institute under the authorship of Armand N. Spitz. A basis for future work is established.

For further study by both electric load and weather forecasters, use may be made of a paper read before the June technical meeting of the AIEE in St. Louis, entitled "The Effect of Weather on System Load," by H. A. Dryar of the Philadelphia Electric Company.

The June 5 issue of Time Magazine carries an informative article on the methods used in weather forecasting for the invasion of Europe.

J. S. Forrest, in the Journal of the Royal Meteorological Society, January, 1943, under the title "The Determination of the Location and Frequency of Thunderstorms by a Radio Method," and under the title "Tracing Thunderstorms—A Use for Atmospherics," describes equipment by which the intensities of the radiation field of a lightning stroke are recorded at remote points. There is evidence that the speed and direction of, and the frequency (of the order of 120 per minute) of flashes at, a storm-front can be established with his equipment which is now being used by some electrical utility men in the United States and in Great Britain. Reporting some experiments, he plots storm intensity simultaneously for three stations, and on these charts correlates the time of occurrence of power system breakdowns in the area. Other meteorologists have tried like methods with indifferent success, however, once the progress and direction of electrical storm-fronts are established by forecasters at remote points —now only 10 to 20 kilometers—predicting should become still more authoritative.

Researches

Meteorologists and climatologists should presently have the time and opportunity to absorb into peace-time weather forecasting many such advances in weather technique and, as well, the results of analyses of a very large amount of global and stratospheric weather and radio interference data which has already been accumulated and used for war purposes: can we expect more authoritative, and especially longer-range, weather forecasting?

During the war, meteorologists on this continent have said very little about radio in connection with studies of weather forecasting. The possibilities are such that further attention should be given now to the inter-relations of electronics and weather. Engineers and meteorologists should look forward to the postwar publication of work done during the war on electronic reflections.

(*Continued on Page* 368)

Transmission and Distribution Committee Meeting

Frank Sanford, *Chairman*

THE fall meeting of the Transmission and Distribution Committee was held at the Statler Hotel, Buffalo, New York, October 9 and 10, 1944. Attendance was the largest in recent years, there being 134 members and invited guests present.

Mr. H. M. Sharp, Buffalo Niagara & Eastern Power Corporation, presented a paper on Street Lighting Trends that may Influence Distribution and Operating Practices. He predicted increased mounting heights with a trend toward the elimination of upright ornamental units in favor of the bracket and pendant type of luminaire. This will call for more platform trucks, overhanging brackets and heavier poles. A considerable increase in the use of gaseous conductor lamps for street lighting was also predicted as these have a number of advantages and their use is bound to spread. Mr. Sharp urged strong support of standardization efforts to limit the otherwise inevitable increase in the number and types of equipment and resulting higher costs.

Following group meetings sponsored by the Street Lighting, Line Hardware and Timber Products Subcommittees, the value of Job Training by the use of models was demonstrated by Mr. E. R. Paige, Buffalo Niagara Electric Corporation. Miniature pole lines, buses and transformers were used in conjunction with a reflector type voltmeter and circuit diagrams to explain transformer connections and illustrate electrical hazards. The miniature equipment was designed to use a primary voltage of 120 volts.

At the group session on Timber Products, Mr. Alexander Maxwell, Director of Engineering EEI, reported that a suggestion had been received from a pole supply company urging the adoption of a common standard of framing for creosoted pine poles for rural construction to enable suppliers to meet the needs of the power companies more readily and still take care of the unusually heavy demand for war and other government purposes.

A method for compensating for line and transformer regulation by graphic control of generator voltage was described by Howard E. Stites, Central Illinois Public Service Company. Mr. Stites reported that this method had been placed in operation at a number of station in his company with very gratifying results.

Mr. T. H. Haines, Boston Edison Company, discussed the intelligent use of performance records as an aid to improving service reliability. By means of studies based on these records, troubles and outages on 4 kv overhead lines and in the undeground system were halved over a period of 10 years. Among the improvements made as a result of these analyses was the double spacing of line wires, use of improved types of line wire, better repair methods, lowering of transformer terminal boards below oil level, improved design of oil switches, and modernization of older switches during repair work. The value and use of similar records in the Union Electric Company of Missouri was described by Mr. W. R. McMillan.

Mr. H. L. Davis, Jr., Philadelphia Electric Company, presented a report on the activities of the Radio Technical Planning Board. Referring to the anticipated new uses for radio, and the expected expansion of present services, Mr. Davis outlined the reasons that make it necessary to revise the present spectrum allocation system. (Statements presented to the Federal Communications Commission in the current radio frequency allocation hearing are reproduced elsewhere in this issue of the BULLETIN.)

A plan to publish an explanatory review of brackground information on the subject of Preferred Voltage Ratings in the near future was announced by Mr. Howard P. Seelye, The Detroit Edison Company.

Mr. A. E. Silver, Ebasco Services, Inc., presented a progress report on the work of the EEI-NEMA Joint Committee on Distribution Transformer Standards. Mr. Silver indicated that this committee is actively engaged in collecting data and reviewing suggestions that are being received from equipment users and manufacturers in an effort to determine needs and preferences.

Wind and Weather Predictions as an aid to load forecasting was discussed in a paper presented by Mr. A. E. Davison, Hydro-Electric Power Commission of Ontario, in which he reviewed the needs of power companies for the best possible weather information.

Colored movies of hot-line maintenance operations on towers and poles were shown by Mr. L. L. Crump, J. R. Kearny Corp. Mr. Crump reported increased use of such tools and predicted increased application to distribution voltages.

Commenting on New Distribution Problems, Mr. L. R. Gaty, Philadelphia Electric Company, emphasized the need for a study of diversified demands as an aid in designing future distribution systems. Among possible new loads that may be expected to effect system design, Mr. Gaty mentioned the probable 5 kv demand of the heat pump, the need for large quantities of hot water with automatic home washers requiring little power, and a timer heat control applied to higher capacity range surface units to give faster cooking.

Mr. G. D. McCann, Westinghouse Electric & Manufacturing Company, explained Lightning Protection of Sub-Transmission Lines in the 13.8 to 44 kv class.

Mr. G. D. Blair, Chairman of the Tree Clearance Subcommittee, directed attention to the EEI Line Clearing Manual for Overhead Conductors, published in March of this year. He reported many favorable comments received and that requests for over 3,200 copies had been filled so far.

A paper describing the tunnel method of construction for underground conduit lines was presented by Mr. P. B. Boyd, Georgia Power Company, who stated that this type of construction has been used successfully in heavily congested areas in Atlanta. By eliminating most of the former repaving expense, this type of construction became competitive in cost with the open trench method in paved areas.

Describing two years' operating experience with 69 kv oil-filled cable, Mr. Maitland Roach, Philadelphia Electric Company, reported only minor trouble. Of 13 howler alarm operations to date, four were attributed to small lightning surges which caused fusing due to small clearances in micro-switch relay circuits. Arresters have corrected this. A fifth alarm was caused by contacts being set too close so that heat changes caused contact. The other alarms were due to oil leaks in stop-joints.

Mr. G. S. Van Antwerp described, with the aid of lantern slides, a great variety of devices developed by the Philadelphia Electric Company for use in underground maintenance work. Many of these improvements were the results of employee suggestions and their adoption led to substantial savings in labor and material costs.

Preliminary tables on AC Network Operation 1941-1943 were presented by Mr. Andrew Bodicky, Union Electric Company of Missouri; and a draft copy of the Cable Operation Report for 1942 was submitted by Mr. E. F. Nuezel, Cincinnati Gas & Electric Company.

During round table discussion, the details of a new phos-copper brazed spider for AC Network Neutrals was described by Mr. G. B. McCabe, Detroit Edison Company. Mr. G. H. Fiedler, Rochester Gas & Electric Corporation, discussed the use of a special tape in joints to hold gas pressure in low pressure cables and also described its application to flexible cable joints on a bridge structure.

The next meeting is scheduled to be held in Pittsburgh, February 8 and 9, 1945.

Electrical Equipment Committee Meeting

H. S. Fitch, *Chairman*

THE fall meeting of the Electrical Equipment Committee in Pittsburgh, October 5 and 6, was one of the best attended sessions in recent years—there being about 85 members and guests present.

The regular semi-annual report on Apparatus Troubles for the period ending August 15 was presented by Mr. F. S. Brown. This report covered a total of 165 cases of which 28 were classified as major and 137 as minor. The average number of failures for this period is 28 per month as compared with a six-year average of 20 per month. Of the major cases of trouble those reported most frequently were oil circuit breakers (5), power transformers (4), turbo generators (3), and induction regulators (3). Among minor troubles those occurring most frequently were induction regulators (19), power transformers (15), constant current transformers (14), lightning arresters (13), and motors (11). Following the presentation of the report considerable time was devoted to an informal round table discussion of several of the more important troubles.

The progress of joint committee work on power circuit breakers was reviewed by Mr. Wilbraham. He indicated that the revised ASA Standard on Power Circuit Breakers would be ready for submission to letter ballot of the Sectional Committee in the near future. Prospects were good that the vote would be favorable and that the Standard would be released for publication.

A summary of reports of oil fires was presented by Mr. Guldi on behalf of Mr. Conwell. In this connection he reviewed recent developments involving the use of water in combination with CO_2 and also the use of water spray under nozzle pressures of 600 to 700 lbs.

The results of the work of the Joint AIEE-ASME Committee on Turbo Generator Standardization were discussed by Mr. M. S. Oldacre, Chairman of the AIEE Group. He presented a table of proposed standards for 3600 rpm machines as favored by the majority opinion. This included six units with turbine ratings ranging from 11.5 to 60 mw and with turbine maximum capabilities 110 per cent of rating. Generator ratings ranged from 13.5 to 70.6 mva at 0.85 power factor. For generators of 23.5 mva and above the values were for hydrogen cooling at 0.5 lb. Increased generator capabilities at 15 lbs hydrogen pressure were pointed out and a number of other proposed standard characteristics were discussed. The AIEE group expects to submit a report in the near future to the AIEE Standards Committee for action.

The work of the Radio Technical Planning Board was reviewed by Mr. Kent with reference to its bearing on present and proposed use of radio for emergency communication purposes by power comanies. He also referred to the current Federal Communications Commission hearing on radio frequency allocations. (Statements presented to the Commission October 21 on behalf of the electric utilities are reproduced elsewhere in this issue of the BULLETIN.)

Mr. Morris, Chairman of the Meter and Service Committee, reported that work was practically completed on the standardization of bar type current transformers and thermal demand meter scales, and also on the preparation of safety rules for metermen. He briefly outlined the general plans of his committee for the coming year.

Personnel matters, with particular reference to problems associated with collective bargaining, were discussed by Mr. Hughes, who emphasized the need for close cooperation between the Operating and Personnel departments.

Mr. DeBeech, Chairman of the Foreign Practice Group, reported briefly on English experience with robot bombs.

The development of the Utilities Wartime Aid Program for coordinating the work of utilities with the work of the Army Corps of engineers and with comparable branches of the Navy and the Maritime Commission was reviewed by Mr. Fitz. He described the scope of the activity in his company's territory and cited specific instances illustrating how the program had been mutually helpful and worthwhile.

Mr. Corney briefly reviewed the development of the Mystic Plant of the Boston Edison Company. He described in detail the electrical features of the station, illustrating with slides a number of the more interesting points.

The entire afternoon session on Friday was devoted to a symposium on principles of relaying large transmission systems. Papers were presented by Mr. Logan of Georgia Power Company, Mr. Powell of the Niagara Hudson System, and Mr. Knapp of Shawinigan Water and Power Company. Following prepared discussions by Messrs Price, Poage, J. C. Jones, Ridenhour, and McKinley, there was additional informal round table discussion. The wide range in types of transmission systems covered in the papers and discussion served to bring out very clearly the field of application and relative advantages and disadvantages of various relay schemes. At the previous meeting of the committee a similar session was devoted to the metropolitan type of company. It is planned to reproduce the papers and discussions from these two sessions in the form of a report sponsored by the committee so that this information may be more generally available.

Indiana Electric Association Annual Meeting

THE annual meeting of the Indiana Electric Association, held at French Lick Sept. 20-22, attracted some 500 utility men from Indiana and nearby states.

Presenting his personal view of utility prospects in peacetime, Tom P. Walker, president of the Council of Electric Operating Companies, expressed pride that the utilities are about to emerge from war with a record that no other industry can match. "We have met our responsibilities," Mr. Walker stated. "We are lean and efficient; our prices are down, and we stand at the threshold of great opportunities for public service."

"Hard work, initiative and ingenuity have been the American way of satisfying material needs," Dean A. A. Potter of Purdue University told the conference. "Our entire future depends on our remaining a creative people." Discussing the relationship between electric power, national productivity and wages Dean Potter pointed out that there is a direct relation between the wages of an industrial worker and the power he has at his disposal to increase his productivity.

Dean Mitchell, president of Northern Indiana Public Service Co., in a vigorous defense of the capitalistic system, which he characterized as the foundation of the "American Way," warned that this system faces a critical challenge in the problem of distribution and unemployment, after the war. Given solutions to these, he felt that industry would enter the greatest era of production and expansion that the country has ever known.

L. B. Schiesz, vice-president of Public Service Co. of Indiana, speaking as chairman of the wartime committee for the cordination of power supply for the Indiana area, traced development of the interconnected power system in the state as it has been expanded since 1940 to meet demands of war.

Functionally, public information and public relations are synonymous J. W. McAfee, president of Union Electric Co. of Missouri, told the conference. He recommended that utilities give their customers information on what they are paying for and why. "It is information that the public wants, and a guide to the way to use it," Mr. McAfee stated. Utility executives will also find it profitable, he felt, to re-examine company practices that involve direct personal contact with customers. He recommended that public information be geared to public interests and not to the interests of utility management.

A goal of double the average residential usage of electricity in the first five years after war, the relighting of all commercial and factory buildings in 10 years and the extension of rural lines to all serviceable farms within five years, was suggested to the utility industry by S. B. Williams, editor of *Electrical World*.

Other speakers included Hassil E. Schenck, president of the Indiana Farm Bureau and C. W. Kellogg, president of EEI. (Mr. Kellogg's address appeared in the October issue of the BULLETIN.)

Officers of the Indiana Electric Association for the coming year are: President, L. B. Schiesz, vice-president, Public Service Company of Indiana, Inc.; vice-president, Arnold Hogan, Indiana Service Corp.; secretary-treasurer, E. F. Hauser.

Rocky Mountain Electrical League Annual Meeting

THE menace of public ownership and high taxes to the business-managed electric utility companies was emphasized by speakers at the annual meeting of the Rocky Mountain Electrical League, October 2 and 3, in Denver. Private companies were urged to protect themselves by asserting their rights, and a number of speakers pointed out the achievements of the electric utilities in bettering life through their efficient service.

Warning that failure to take steps which will stem the rising tide of government encroachment and ruinous taxes on all business means gradual destruction and socialization of private enterprise was sounded by Kinsey M. Robinson, president of the Washington Water Power Co. and Vernon Scott, vice-president of the National Tax Equality Association.

Mr. Scott pointed out how untaxed cooperatives build up surpluses to buy up competitive, tax-paying, business-managed companies.

John Loiseau, president of Public Service Co. of Colorado, paid tribute to the holding companies by citing how they had brought electric service to thousands of communities where power would otherwise never have been transmitted.

C. E. Greenwood, commercial director of the Edison Electric Institute, predicted that electric utilities will re-enter the appliance selling field after the war. A program to bring merchants and power companies into amiable but competitive merchandising practices is already in the making, he reported.

Officers for the coming year were inducted immediately instead of on January 2 of the following year as in the past. When Arthur Prager, president of Albuquerque Gas & Electric Co., resigned because of ill health immediately following his election as president of the league, Floyd F. McCammon, vice-president and superintendent of electric operation of Public Service Co. of Colorado, was elected.

Other officers for the coming year will be W. D. Johnston, Mountain States Power Co.; E. T. Tengdin, Inland Utilities Co.; Luke R. Storey, Home Gas & Electric Co., and Ross H. Adams, manager of the electric department of Hendrie & Bolthoff Manufacturing Co., Denver, vice-presidents. W. C. Sterne and Harry Adler, both of the Arvada Electric Co., Greeley, Colo., treasurer and assistant treasurer; George E. Lewis, manager.

President McCammon has appointed these division heads: Lloyd W. Edwards, Mountain States Power Co., engineering; E. L. Garihan, Mine & Smelter Supply Co., Denver, manufacturers; Ralph E. Johnson, Sturgeon Electric Co., Denver, contractors; H. T. Rankin; Public Service Co. of Colorado, sales; W. D. Virtue, Public Service Co. of Colorado, accounting; Ray Jones, Ray Jones Washing Machine Co., retailers; C. C. Baker, Colorado Central Power Co., retiring president of the league, general section chairman; and Arthur Prager, vice-chairman.

Robert E. Richardson

ROBERT E. RICHARDSON, 83, former head of the Rate Department of Electric Bond and Share Company, died October 11 in New York after a long illness.

Mr. Richardson was graduated from the Massachusetts Institute of Technology in 1885 and took up the then new science of electrical engineering. In Chicago he did pioneer work in electrical construction, and in 1887 with two assistants installed lights in the first Pullman car to be equipped with electricity. This car was arranged for President Grover Cleveland for a trip through the South.

Mr. Richardson built the first outdoor lighting system in the country for the World's Fair in Chicago in 1893.

From 1900 to 1910 he was General Manager of the Kansas City Electric Light & Power Company. Leaving Kansas City in 1910, he became General Manager of the Consumers Power Company, with headquarters in Kalamazoo, Mich. In 1915 Mr. Richardson went to New York with the Electric Bond and Share Company, to form a Rate Department which he headed until his retirement in 1933.

Thomas R. Crumley

THOMAS RALSTON CRUMLEY, president of the Jersey Central Power & Light Company, died on October 5, following an illness which had recurrent phases since 1942.

Mr. Crumley had been in the public utility field since he took his first training course with the General Electric Co. following his graduation from college in 1901.

After attending the public schools at Wayne, Pennsylvania, and graduating from Radnor High School, Mr. Crumley entered Pennsylvania State College where he obtained the degree of Bachelor of Science in Electrical Engineering.

He left the General Electric Co. at Schenectady, N. Y., in 1903 to spend two years as construction engineer with the Hudson River Water Power Co., and in 1905 went to Philadelphia as assistant superintendent of the Philadelphia and Westchester Traction Co. In 1907 he became master mechanic of the Sharon Railway Co., at Sharon, Pa., and then assistant master mechanic for the Mahoning and Shenango Railway and Light Co. the following year. In 1909 he moved to Lexington, Ky., as assistant master mechanic of the Blue Grass Traction Co., and in 1911 went to Evansville, Ind., as Chief Engineer of the Evansville Railway Co.

In 1915 he became chief engineer of the General Engineering and Management Corp. with headquarters in New York City, and served as president from 1921 to 1928, when he became president of Jersey Central.

As president of Jersey Central he has seen the company through a period of consolidation, integration and expansion of facilities. In 1928 the total number of customers served approximately 89,000, compared with 150,000 at the present time. Following the original formation of Jersey Central through the consolidation of numerous smaller gas and electric companies from Pompton Lakes to Cape May in 1924 and 1925, the Eastern New Jersey Power Co., serving the Shore area, was purchased by Jersey Central in 1931 under Mr. Crumley's management, completing the present system of the company.

Light, Vision and Seeing

THE answer to every practical question about seeing in its relationship to light and vision is fully and clearly explained in the most recent book of Dr. Matthew Luckiesh on Light, Vision and Seeing. Dr. Luckiesh has packed into this volume of approximately 300 pages the results of three decades of research on light.

In earlier works, Dr. Luckiesh has given to the lighting industry and to the public, a fund of authoritative and valuable information, much of it along technical lines. But in this latest volume, he unfolds clearly the foundation on which adequate light and seeing tasks can be built.

The book is easily read and understood, making it possible for the scientific basis for lighting practice to be applied by those responsible for adequate light in the school, office or factory. The test is well illustrated.

Here is a scientific treatise in textbook form which many utilities can use effectively. It is also ideal for use in study groups.

The list price of Light, Vision and Seeing is $4.50. It is suggested that if any utility wishes a quantity delivered at one point, application be made to the Commercial Department, EEI, for special quotation.—C.E.G.

Testimony on Behalf of Utilities

(*Continued from Page* 347)

several regional disasters and numerous local emergencies,

C. That in fulfillment of this need, they have developed and now operate an established emergency radio communication service which is in use by companies which collectively supply electric service to about half the nation's population,

D. That they own and operate nearly 60 per cent of all stations licensed in the Special Emergency service.

E. That they desire to further expand both their radio systems and their use thereof for the purpose of improving their service to the public.

On the basis of these facts the Electric Power Utilities request the allocation of 51 clear channels; 19 for the expansion and perfection of present services below 100 MC; and 32 for contemplated future applications above 100 MC.

In view of the magnitude of the contemplated post-war expansion of radio communication systems by the Electric Power Utilities and of the importance arrangement of such systems in rendering an essential public service, these requests are considered both modest and reasonable.

How We Do It

(*Continued from Page* 348)

I have not mentioned many of the tools used in our program because I am sure you are all utilizing these tools to the fullest extent. Included among them are accident records, including charts and graphs showing frequency, severity and costs; reports to managemnt; safety contests; safety inspections; safety rules; first aid training; use of protective equipment and safety committees.

I have tried to emphasize those things to which I believe firmly we owe any success we have achieved.

1. A whole-hearted and sincere interest on the part of top management.

2. Placing of full responsibility for the prevention of accidents on department heads and supervisory employees.

3. Utilization of every possible means to maintain an active interest in safety among workers and supervisors.

PERSONALS

GEORGE M. KEENAN, formerly general commercial manager of Pennsylvania Power & Light Company, Allentown, has been made chief engineer of the company and J. M. STEDMAN, formerly manager, residential department, has become general commercial manager of the company.

Following graduation from Purdue University in 1913, Mr. Keenan became affiliated with the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, Pa. He worked successively for the Union Gas & Electric Co. at St. Louis in 1917 and the Little Rock Railway & Electric Co. in 1918 before being employed by the Lehigh Navigation Electric Co. of Allentown in 1918. The Lehigh Navigation Electric Co. was one of the predecessor companies that later merged into Pennsylvania Power & Light Co. During the past 26 years, Mr. Keenan has held positions as efficiency engineer, chief system operator at Hazleton, Pa., superintendent of the Pennsylvania-New Jersey interconnection, operating department engineer, manager of the industrial and commercial sales department, general sales manager, and general commercial manager with Pennsylvania Power & Light Co.

For more than two years he has been on leave of absence from the company and has been associated with the War Production Board at Washington in an engineering capacity in connection with electric power supply in the eastern part of the United States. His work with WPB has been completed and he has now returned to Pennsylvania Power & Light to begin his new duties.

A graduate of the University of Michigan, Mr. Stedman became connected with Pennsylvania Power & Light in Allentown in 1932 and was appointed manager of the residential department in 1937. Early in his career he was associated with the Burroughs Adding Machine Co. at Detroit, Mich., and with the Westinghouse Electric & Manufacturing Co. in the merchandise department at Mansfield.

MISS HELEN L. KIRTLAND has been appointed Home Service & Home Lighting Director of the New Jersey Power & Light Company with headquarters at Dover, New Jersey.

Miss Kirtland has had sixteen years' experience in Home Service and Home Lighting work, having held positions of responsibility with New York State Electric & Gas Corporation, Rochester Gas and Electric Corporation, and, for the past five years, as Home Service Director of the Republic Light, Heat and Power Company, Buffalo, New York. She is a graduate of University of Buffalo, with the degree of B.A. Miss Kirtland will report directly to Mr. William F. Moses, Domestic Sales Manager of New Jersey Power and Light Company.

JOHN W. YOUNG, since 1931 executive assistant to the vice-president, New England Power System, has been appointed lighting engineer, reporting to E. W. Dillard, electrical engineer. Following graduation from Washburn College, Topeka, Kan., Mr. Young spent 21 months overseas with the U. S. Army Engineers in World War I. He then attended the University of Pittsburgh, and for a time was connected with the Duquesne Light Co., of that city. In 1928 he joined the New England Power System, and for about two years was in charge of the southern district engineer's office at Providence, R. I. In 1931 he was appointed assistant distribution engineer with headquarters at Boston, and a few months later became executive assistant.

E. P. LOVEJOY has been appointed to the newly created position of news director of the Detroit Edison Co., reporting to the president. Mr. Lovejoy's work as news director will be in addition to his present assignments as a member of the President's staff.

Mr. Lovejoy attended the University of Michigan and before joining the Detroit Edison Co. in 1928 was employed by the General Electric publicity department at their executive offices in New York. He left Detroit Edison in 1934 to work at the Detroit Electric Furnace Co., of which he was later president, until the business was sold in 1938 to Kuhlman Electric Co., whereupon he returned to Detroit Edison. Mr. Lovejoy is an associate member of the American Society of Mechanical Engineers.

JACK G. HOLTZCLAW, president of the Virginia Electric & Power Co., has been named chairman of the Richmond Committee for Economic Development.

CHARLES W. FLOREY, superintendent of the Wisconsin Power & Light Co.'s steam and waterworks plants at Beloit, recently retired after 37 years of service.

T. WILSON VAN MIDDLESWORTH, who has been with Public Service Corp. of New Jersey and predecessor companies 42 years and has been treasurer since 1917, has been elected a director, to fill a vacancy on the board occasioned by the death of George Barker. He is a member of the boards of directors of the subsidiary operating companies.

RAYMOND R. STODDARD has been appointed industrial engineer for the Fitchburg (Mass.) Gas & Electric Light Co., Rockland (N. Y.) Light & Power Co., Concord (N. H.) Electric Co., Exeter & Hampton (N. H.) Electric Co., and other utilities whose headquarters are located at 89 Broad Street, Boston, Mass. Mr. Stoddard served for two years as power sales engineer at Binghamton, N. Y., after being graduated in electrical engineering from the Massachusetts Institute of Technology, being connected with the local division of the present New York Power & Light Corp. He was then power engineer with the Philadelphia Electric Co., for 12 years; his duties included rate activities.

JAMES B. BLACK, president of the Pacific Gas & Electric Co., San Francisco, has been elected a director of the U. S. Steel Corp. to fill the vacancy on the board created by the death earlier this year of William J. Filbert. Mr. Black thus becomes the first Pacific Coast director of the steel corporation.

In preparation for resumption of new business activities in the post-war period, the staff organization of the commercial department of the Buffalo Niagara Electric Corp. at Buffalo, N. Y., is being rearranged on a functional basis. The following assignments have been announced by Vice-President Merrill E. Skinner as the first phase of the department reorganization:

HOWARD M. SHARP, formerly lighting bureau manager, has been made manager of the residence and farm bureau, handling all commercial relations and load-building activities in the residence and farm field.

C. P. YODER, formerly manager of the power and heating bureau, becomes manager of the commercial and indus-

trial bureau, in charge of all commercial, industrial and municipal activities.

E. A. BRAND, formerly assistant manager of the power and heating bureau, becomes manager of the technical bureau, furnishing technical information and layout service on wiring, lighting and special equipment, comparative cost studies, sales training, installation and repair service, market analyses and sales research, budgets and records.

J. ARTHUR APSEY, manager of the advertising bureau, will handle all commercial advertising exhibits and displays.

ELMER E. KLINE, since 1931 superintendent, electric meter department, Cincinnati Gas & Electric Co., has been appointed superintendent of the company's electric distribution department according to an announcement by E. S. Fields, vice-president and manager of the electric department.

Advancement of Mr. Kline to his new position marks his 41st year of service with the Cincinnati utility, which he joined in 1904 as an electric meter apprentice. He advanced through the years becoming assistant superintendent of the department in 1923 and superintendent in 1931. In recent years he has also been in charge of the appliance service and repair department.

Since 1931 Mr. Kline has been a member of the metering and servicing committee of the Association of Edison Illuminating Companies and likewise a member of the meter committee of the Edison Electric Institute.

Succeeding Mr. Kline as superintendent of the meter department is JAMES S. LINEBACK who has been with the company for 20 years and was general foreman of the department's premise test department.

Memo on Post-War Taxes

(*Continued from Page* 338)

of their gross revenue in federal income taxes. It may be that electric cooperatives and government-owned electric utilities should also pay 15 per cent of their gross income in federal taxes.

If this were done, then each utility customer throughout the United States, whether served by a private company, a co-op, or a government-owned concern, would pay to the support of his government about the same amount in proportion to his use of service. Such an arrangement would bring about fair competition between the three groups and would not in any way be unfair to the co-op or to the government-owned utility. The only other solution to the problem is to reduce taxes on company business to the level now enjoyed by cooperatives and government-owned business ventures.

Some action along the above lines is necessary if we are to reach the goal used by all post-war planners—an annual income of from 120 to 160 billion dollars and jobs for everyone who wishes to work.

The Weatherman Can Help

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Among others, researches and studies waiting upon interested engineers and physicists are:

Snow-water carries fertilizing agents in varying quantities: do the activities of man, as exemplified by a 380,000-volt transmission line traversing agricultural lands, affect deleteriously or beneficially the deposit of nitrates and like fertilizing and growth-promoting agents, by such means as relatively intense electrostatic fields and the formation, usually in quite small quantities by corona, of ozone and of nitrogen derivatives?

Effect of dust particles in the air, especially in metropolitan districts, regarding which the distributors of electric energy have a lively interest, whereas little attention is given to the major effect which air contamination has upon health: will it be economical, when all losses are accounted, to condition by dust removal and by recovery of salvaged chemicals, chimney discharges in urban areas, or must industry continue to restrict production in order to limit the discharge of harmful gases and of waste from chimneys during unfavorable weather?

Thermal storage, heat recovery and entropy of naturally stored heat reserves in large bodies of water: can this stored heat be used more economically by man than it is now, that is, as a natural moderating influence upon weather and upon air temperatures along the shores? and;

Variations in the incidence of normal air-earth electronic flow and balance upon the earth's surface: how do these variations affect neighboring transmission lines?

CONVENTIONS AND MEETINGS

NOVEMBER

9-10	Southeastern Electric Exchange, Advertising and Sales Conference, Henry Grady Hotel, Atlanta, Ga.
14-17	National Association of Railroad and Utilities Commissioners, Fontenelle Hotel, Omaha, Neb.
16-17	Pennsylvania Electric Association, Communications Committee, Roosevelt Hotel, Pittsburgh, Pa.
24	Southeastern Electric Exchange, Executive Conference, Henry Grandy Hotel, Atlanta, Ga.
27-28	Prime Movers Committee, EEI, Commodore Hotel, New York, N. Y.
27-30	American Society of Mechanical Engineers, Pennsylvania Hotel, New York, N. Y.

DECEMBER

6-8	National Association of Manufacturers, Waldorf-Astoria Hotel, New York, N. Y.
8	American Standards Association, Hotel Roosevelt, New York, N. Y.

JANUARY, 1945

22-26	American Institute of Electrical Engineers, Engineering Societies Building, New York, N. Y.

FEBRUARY

8-9	Transmission and Distribution Committee, EEI, William Penn Hotel, Pittsburgh, Pa.
14-15	Electrical Equipment Committee, EEI, Netherland Plaza Hotel, Cincinnati, Ohio.
15-16	Accident Prevention Committee, EEI, Hotel Cleveland, Cleveland, Ohio.

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